



National Research
Council Canada

Conseil national
de recherches Canada

ERG-99-1

Division of
Electrical Engineering

Division de
génie électrique

Radiation Pattern Measurements of a TRANLINE Antenna on a Scale Model of the CH-135 Bell Helicopter

R. Balaberda and J. Hazel

July 1988

87-04604/

Copyright 1986 by
National Research Council of Canada

Permission is granted to quote short excerpts
and to reproduce figures and tables from this
report, provided that the source of such
material is fully acknowledged.

Additional copies are available free of charge from:

Editorial Office, Room 301
Division of Electrical Engineering
National Research Council of Canada
Ottawa, Ontario, Canada
K1A 0R8

Copyright 1986 par
Conseil national de recherches du Canada

Il est permis de citer de courts extraits et de
reproduire des figures ou tableaux du présent
rapport, à condition d'en identifier clairement
la source.

Des exemplaires supplémentaires gratuits
pourront être obtenus à l'adresse suivante:

Bureau de publications, Pièce 301
Division de génie électrique
Conseil national de recherches du Canada
Ottawa (Québec) Canada
K1A 0R8

**RADIATION PATTERN MEASUREMENTS
OF A TRANLINE ANTENNA ON A
SCALE MODEL OF THE CH-135 BELL HELICOPTER**

R. Balaberda and J. Hazell

ERB-991

NRCC No. 26491

JULY 1986

TABLE OF CONTENTS

	Page
ABSTRACT/RÉSUMÉ	v
PART I: PROJECT SUMMARY	1
INTRODUCTION	1
MEASUREMENTS PERFORMED	1
INSTRUMENTATION	2
MEASUREMENT TECHNIQUES	5
RESULTS	7
CONCLUSIONS	9
ACKNOWLEDGEMENTS	10
REFERENCES	10
 PART II: RADIATION PATTERNS	 11
(a) Roll, Pitch, and Yaw plane patterns: 2 to 30 MHz in 1 MHz intervals; rotor in fore-aft position	 11
(b) Roll, Pitch, and Yaw plane patterns: 3 to 29 MHz in 2 MHz intervals; rotor in port-starboard position	 99
(c) Contour plots at 8, 16, and 24 MHz; rotor in fore-aft position	 143
PART III: APPENDIX A	157

FIGURES

1 Scale model of CH-135 Bell helicopter	3
2 NRC automated aircraft range	5
3 Radiation efficiency and relative power in E-theta	9
A1 Aircraft, coordinate system, and field components	157

TABLES

1 Principal plane crossover errors	8
A1 Location and field components of the six crossover points	 158

ABSTRACT

Measured radiation patterns are presented for a "TRANLINE" antenna mounted on a 1:24 scale model of the CH-135 Bell Helicopter. In addition to radiation pattern efficiency and relative power calculations, a brief description of the NRC Automated Aircraft Range is included.

RÉSUMÉ

Des diagrammes de rayonnement sont présentés, tels que mesurés, pour une antenne "TRANLINE" montée sur un modèle à l'échelle de 1/24 de l'hélicoptère CH-135 de Bell. L'efficacité des diagrammes de rayonnement et la puissance relative de l'antenne sont calculées, et le système automatisé de radiophares pour aéronefs est décrit.

**RADIATION PATTERN MEASUREMENTS OF A
"TRANLINE" ANTENNA ON A SCALE MODEL OF
THE CH-135 BELL HELICOPTER**

R. Balaberda and J. Hazell

PART I: PROJECT SUMMARY

INTRODUCTION

A request from the Department of National Defence (DND) for antenna measurement assistance was received early in 1984. The project involved the evaluation of radiation characteristics of a Tranline antenna mounted on a CH-135 helicopter model. The Tranline, a shunt type of antenna employing a shorted transmission line to excite the aircraft, has been measured previously on a scale model of the CHSS-2 Sea King helicopter (1).

The Electromagnetic Compatibility Laboratory (EMCL) at Concordia University, Montreal, has been involved in the evaluation of antenna systems by the use and development of numerical modelling techniques. As with the Sea King study, comparisons of EMCL modelling data with NRC pattern data of the CH-135 are expected to verify the validity of EMCL's modelling methods.

The aircraft range on the roof of NRC's Building M-50 was used to obtain radiation pattern measurements of a 1:24 scale model of the CH-135. Data were collected to suit the needs of both DND and EMCL. Patterns from 2 to 30 MHz (full scale) were completed using a computer-based antenna measurement system. The tests, completed in November 1985, included the investigation of rotor blade modulation effects and radiation pattern efficiency calculations.

This report provides a complete summary of the project including range and equipment descriptions, measurement techniques, an outline of measurements performed, and presentation of results.

MEASUREMENTS PERFORMED

Conventions

The authors have assumed the reader is familiar with the nomenclature and techniques pertaining to aircraft pattern measurements, hence little preliminary information is included. However, essential references with

respect to the coordinate system, field vectors, and principal plane patterns are presented in Appendix A.

Although the use of the modelling technique generally requires one to adopt both "scaled" and "full-sized" interpretations, the fundamental purpose of the measurements was to determine full size or actual helicopter performance. Consequently, a full-sized convention was adopted and all quantities refer to the actual craft. Any scaled quantities are specifically indicated as referring to the model.

Department of National Defence Request

Roll, pitch, and yaw principal plane patterns were measured at each of the 29 frequencies between 2 and 30 MHz at 1-MHz intervals. There was one exception: at 4 MHz, the model frequency of 96 MHz was plagued with FM interference; consequently a model frequency of 92.1 MHz, which corresponds to 3.84 MHz, was used. All these principal plane patterns were measured with the rotor blade in the fore-aft position.

Rotor modulation effects were determined with the rotor blade in the port-starboard position by repeating principal plane patterns from 3 to 29 MHz in 2 MHz intervals.

All results are presented in Part II.

Electromagnetic Compatibility Laboratory (Concordia) Request

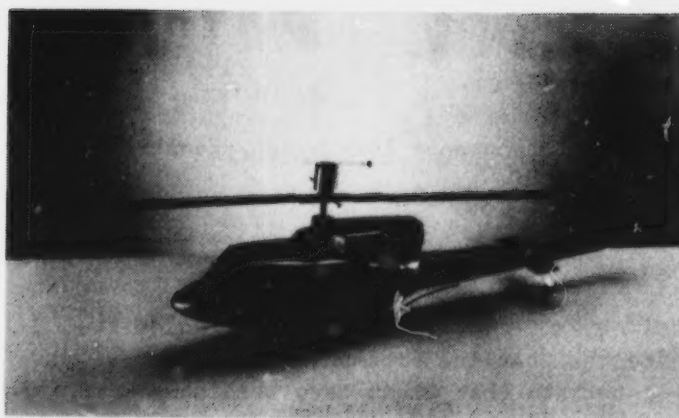
Twenty additional patterns, all conical cuts, were completed at each 2-MHz interval between 2 and 30 MHz inclusive. In accordance with military specification MIL-A-9080 (USAF), θ was held constant for each cut while ϕ was rotated through 360° . θ took the values of 0, 25, 37, 45, 53, 60, 72, 78, 84, 96, 102, 108, 114, 120, 127, 135, 143, 155 and 180° ; note that $\theta = 90^\circ$ is a principal plane pattern. These values of θ correspond approximately to 0.1 increments of $\cos \theta$ (linear cosine spacing of 0.1 increment) and serve to divide the entire spherical surface area surrounding the helicopter into approximately equal areas.

This data was stored on magnetic tape and forwarded to Concordia University.

INSTRUMENTATION

Helicopter Model

A set of scaled construction drawings of the CH-135 helicopter were



(a)



(b)

Figure 1. (a) 1:24 scale model of CH-135 helicopter;
(b) Tranline antenna.

completed by the divisional Drafting Section, and a 1:24 solid aluminum scale model was built in the Development Workshops (see Fig. 1). The model, with hollowed-out fuselage to accommodate signal sources, was electroplated with a 0.01-in. copper coating; this provided a low resistance skin and facilitated antenna soldering at the ground point. The Tranline antenna was located on the port side and extended from the base of the fuselage aft along the tail boom. The actual coordinates were:

Feed location - STA 207.82
BL 21.36
WL 15.69

Termination - STA 297.36
BL 10.463
WL 43.116

Scaled dimensions for antenna length and diameter were 3.501 and 0.0416 in., respectively.

Signal Sources

Miniature "MITEQ INC" oscillators, placed inside the CH-135 model, were used to excite the Tranline antenna. This practice eliminated the risk of pattern distortion that might have been caused if a feed cable to the model from an external oscillator were used. These oscillators were of two types; the mechanically-tuned units offered superior stability compared to voltage-tuned models which required a 2-h stabilization period. Both operating and tuning voltages were supplied by standard 9-V alkaline batteries.

Automated Aircraft Range

The Model Aircraft Range, located on the roof of Building M-50, consists of a moveable model tower (transmit) and fixed wall rotator (receive). The model tower has two adjustable axes: base azimuth (θ) and top spindle elevation (ϕ). Both of these axes are continuously rotatable through 360° in either direction, thereby giving optimum radiation pattern flexibility. The receiving antenna is mounted on the wall rotator which also rotates in either direction, providing convenient field polarization adjustment.

Two types of linearly polarized antennas received the helicopter signal; for frequencies up to 120 MHz, a biconical antenna, and at higher frequencies, a corner reflector with appropriate dipole, were used.

A recently developed computer-based measurement system significantly enhanced measurement speed and accuracy through automation of model tower and wall rotator axes control. In addition, the data acquisition system greatly facilitated range alignment, the completion of a large number of scans, and data storage and presentation procedures.

A block diagram of the NRC Automated Aircraft Range is shown in Fig. 2.

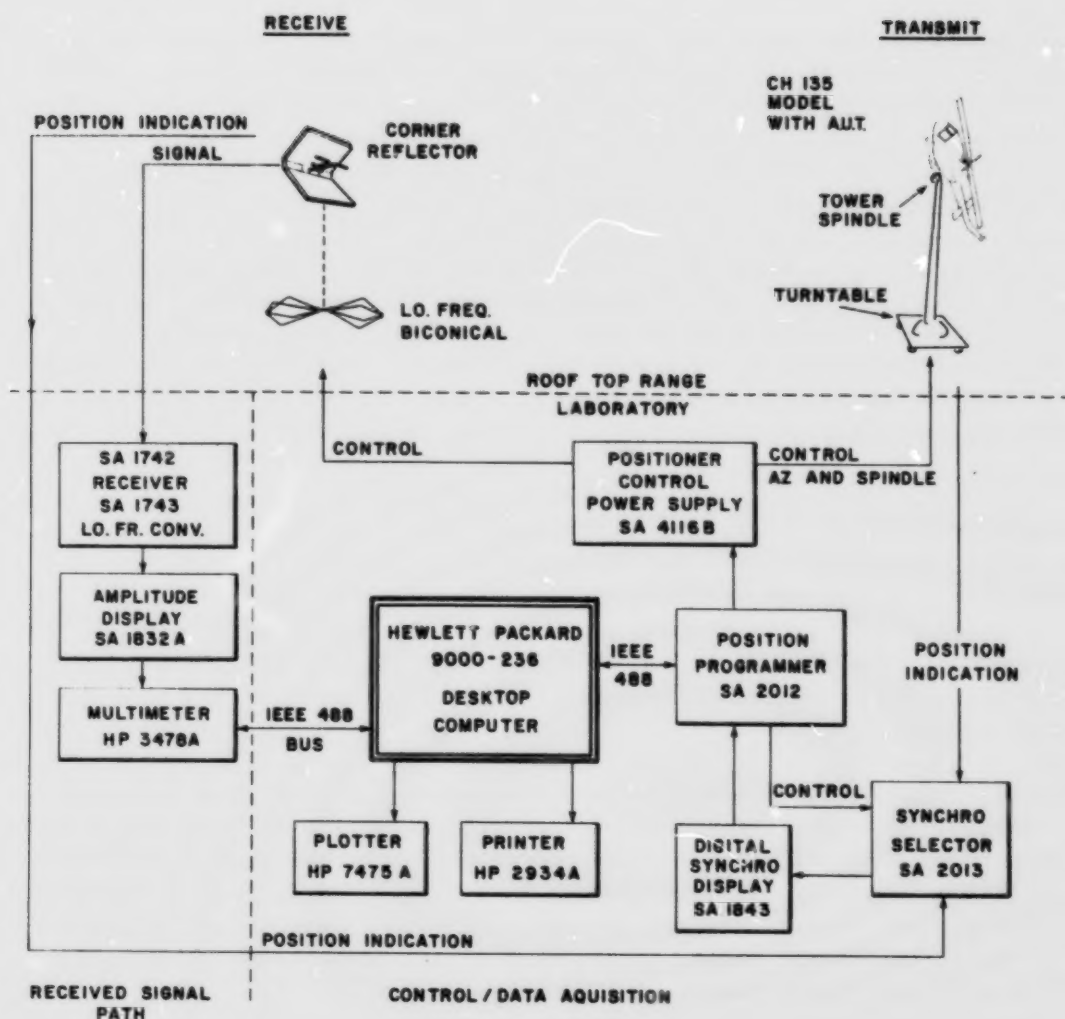


Figure 2. NRC automated aircraft range

MEASUREMENT TECHNIQUES

Reflections

Antenna range surface reflections were minimized through the use of two types of absorber. The first consisted of blocks of rubberized, lossy fibers measuring 2 ft square by 1 ft thick. Manufactured as Type H-12 by

Emerson and Cuming, Inc., this material is listed by the manufacturer as performing with a reflectivity of -20 dB at frequencies between 0.3 and 40 GHz. The second type consisted of chemically treated cardboard wedges manufactured by McMillan Radiation Labs, Inc.; although no specifications are available, sections of this material proved effective for secondary reflection suppression.

The errors caused by reflections were estimated using polarization patterns and principal plane crossover points (see Appendix A). In the situation where there are no reflections, polarization patterns ($\theta = 180^\circ$, ϕ scanning) for E_θ and E_ϕ will both be perfectly circular "figure-eights" - rotated 90° with respect to each other - when plotted on a linearly scaled polar format and crossover errors will not exist.

Each new frequency required experimentation with absorber placement to minimize reflection levels. Once the "figure eight" polarization patterns indicated reasonable amplitude and distribution symmetry, the principal plane patterns were measured and crossover errors determined. Maximum differences of up to 10% of full scale (FS) were considered acceptable, but the average error did not exceed 5% FS. However, the lower frequencies - particularly under 10 MHz - presented some difficulties where the 10% guideline was exceeded.

The computer-based measurement system enabled a consistent method of calculating principal plane crossover errors. A unique file system stored each pattern measured. Upon completion of the principal planes, crossover point values were extracted and errors were calculated and normalized to maximum pattern values. In this manner, reflection levels were estimated in terms of full-scale value instead of fluctuating absolute values which varied with each measurement.

Antenna Separation

The usual criteria for far-field antenna pattern measurements requires that the antenna separation be greater than or equal to $2D^2/\lambda$ or $2D^2 f/c$ where

- D is the largest dimension the test antenna
- λ is the wavelength
- f is the frequency
- c is the speed of light

To ensure uniform illumination, D was chosen to be the largest dimension of the receive antenna (which was larger than the helicopter).

During the different measurements, minimum antenna separation was maintained. In this way, any reflections from the range surface ground screen would enter the absorber with the smallest angle of incidence, and any remaining reflections would experience the greatest angle of incidence in relationship to the receive antenna.

RESULTS

Principal Planes

Pitch, roll, and yaw plane patterns - with the main rotor blade locked in the fore-aft position - are presented in Part IIa. A linearly scaled polar format is used. All patterns for a particular frequency are drawn so that the maximum amplitude measured at that frequency is the full-scale value; the isotropic level is shown with a broken line. Crossover errors are listed in Table 1.

The isotropic level is **stated** as a specific value for frequencies where the 20 conical cuts were measured. In these cases, the isotropic level, which is based on a surface integral of the measured field, could be calculated accurately.

The isotropic level is **estimated** to have a certain value for frequencies where only the principal planes were measured. In these cases, the values are accurate to within about $\pm 10\%$ of the integral method above.

Pitch, roll and yaw plane patterns with the main rotor blade locked in the port-starboard position are presented in Part IIb.

Contour Plots

Part IIc contains contour plots for some of the frequencies where principal planes and the 20 conical cuts were measured. Antenna pattern contour plots illustrate another significant benefit realized through the introduction of the computer-based antenna measurement system. Contour plots contain considerably more information than standard patterns such as those presented in Part IIa and b. In this particular case, each contour plot contains information from 12 standard antenna patterns.

Table 1. Principal plane crossover errors

Frequency (MHz full scale)	Maximum error (% full scale)	Average error (% full scale)
2	27	11
3	8	5
4	11	7
5	8	5
6	11	5
7	14	8
8	12	8
9	13	6
10	7	4
11	6	2
12	5	3
13	5	3
14	10	5
15	7	4
16	3	2
17	9	4
18	11	5
19	6	3
20	9	4
21	8	3
22	5	2
23	8	5
24	6	3
25	6	3
26	5	3
27	4	1
28	7	4
29	14	6
30	6	4

Radiation Efficiency and Relative Power in E_0

Radiation efficiency and relative power in E_0 are shown in Fig. 3. Computed in accordance with MIL-A-9080 (USAF) using the same technique as in ref. 1, efficiency is the ratio of the power radiated in the spherical sector $\theta = [60^\circ, 90^\circ]$ to the total power radiated by the antenna.

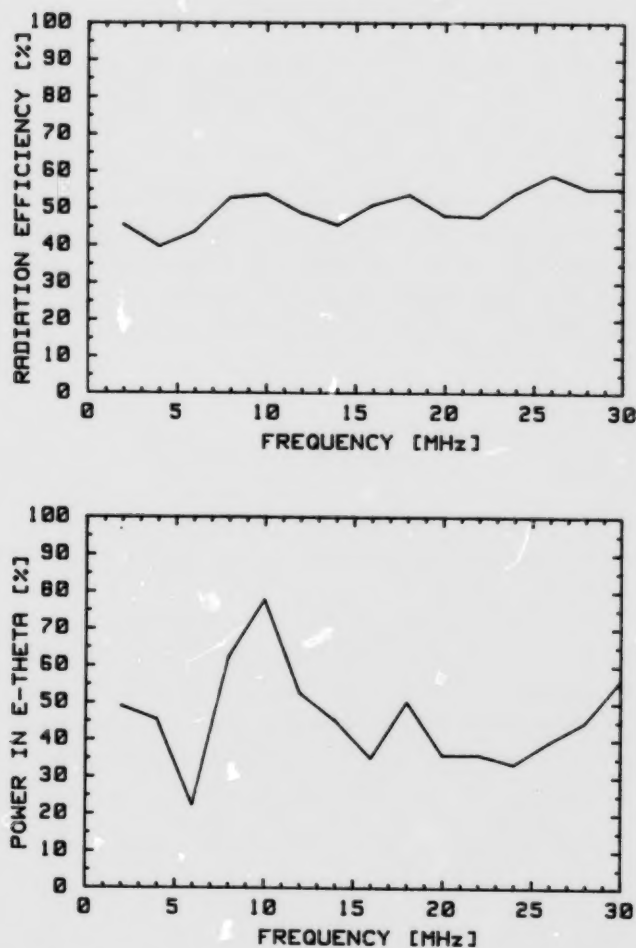


Figure 3. Radiation efficiency and relative power in E-theta

CONCLUSIONS

Radiation patterns of a CH-135 helicopter, equipped with a Tranline antenna have been measured at 29 frequencies from 2 to 30 MHz using modeling techniques. Yaw, pitch, and roll patterns and some contour plots are presented.

The computer-based measurement system greatly facilitated data acquisition, data storage, and pattern presentation. Pattern error estimation for a particular absorber layout was made using the polarization and principal plane patterns.

ACKNOWLEDGEMENTS

The authors wish to express their appreciation to Dr. S.J. Kubina, Concordia University, and Dr. S.R. Mishra and Mr. W. Lavrench of NRC for their suggestions and advice.

Several members of the support staff of the Division of Electrical Engineering made significant contributions toward the fabrication of the CH-135 model. Mr. George Walker of the Drafting Office prepared all the scale drawings, and Mr. Jim Legere from Development Workshops was responsible for the machining and hand crafting of the aluminum scale model.

REFERENCES

1. Y. Bahsoun and J. Hazell. Radiation pattern measurements of a "TRANLINE" antenna on a scale model of the CHSS-2 Sea King helicopter. NRC/ERB-929. December 1980.
2. Y. Bahsoun and S.J. Kubina. A digital data base for the numerical calculation of isotropic level and radiated power by an aircraft antenna. Electromagnetics Laboratory, Concordia University/Loyola Campus, Montreal, P.Q. Technical Note No. TN-EMC-81-06. August 11, 1981.

PART II. RADIATION PATTERNS

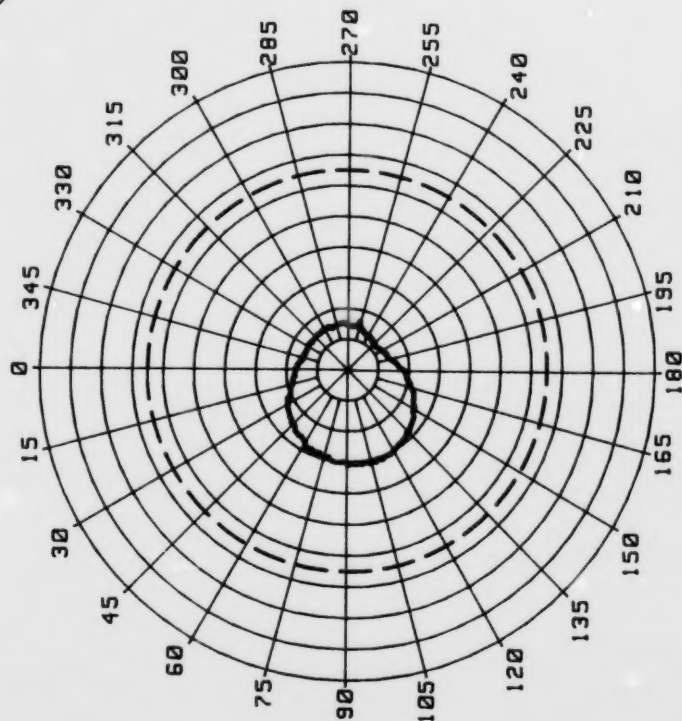
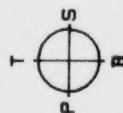
(a) ROLL, PITCH, and YAW PLANE PATTERNS

2 TO 30 MHz IN 1 MHz STEPS

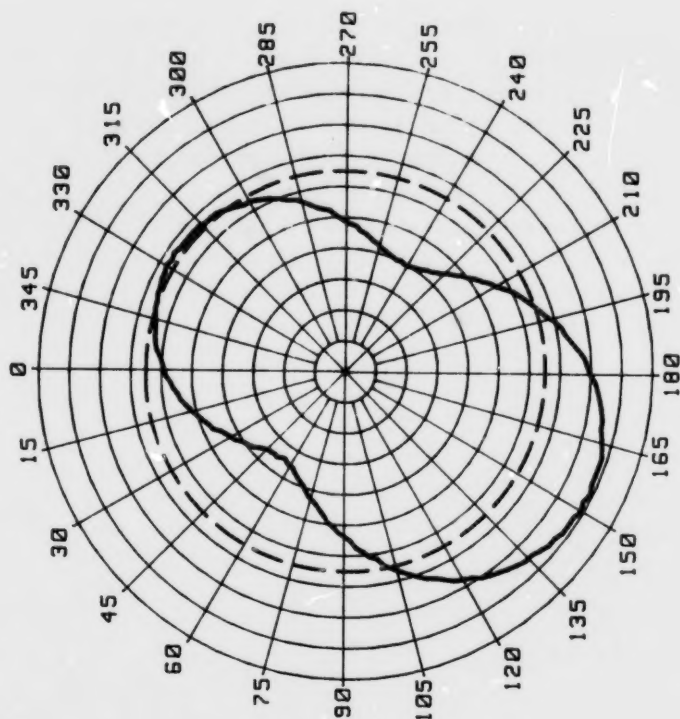
ROTOR IN FORE-AFT POSITION

These patterns are presented on a linearly scaled polar format. All patterns for a particular frequency are drawn such that the maximum amplitude measured at that frequency is the full-scale value; the isotropic level is shown with a broken line. A position diagram showing helicopter bearings appears below each main title.

CH-135 MODEL HELICOPTER 48.00 MHz
CH-135 HELICOPTER 2.00 MHz
ROLL PLANE PATTERNS



E-THETA



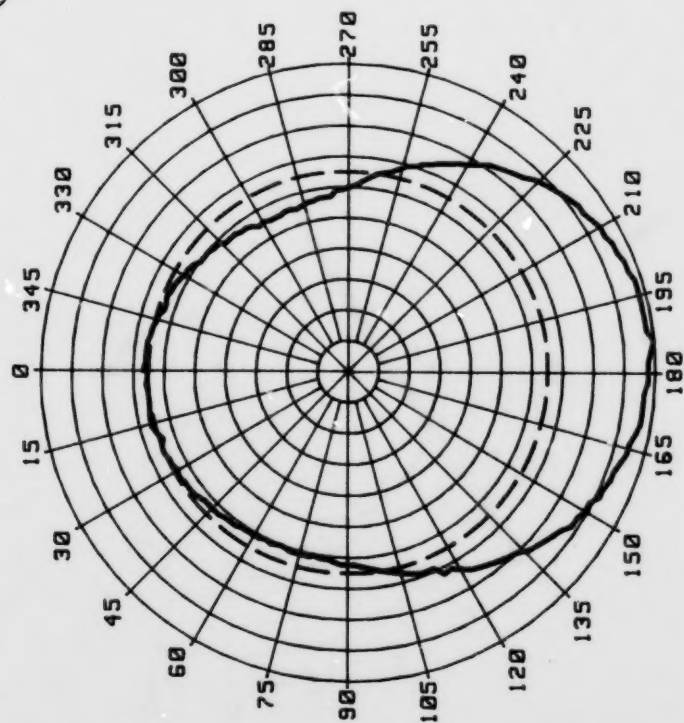
E-PHI

THE FULL-SCALE VALUE IS 1.54 [ISOTROPIC]
--- ISOTROPIC LEVEL

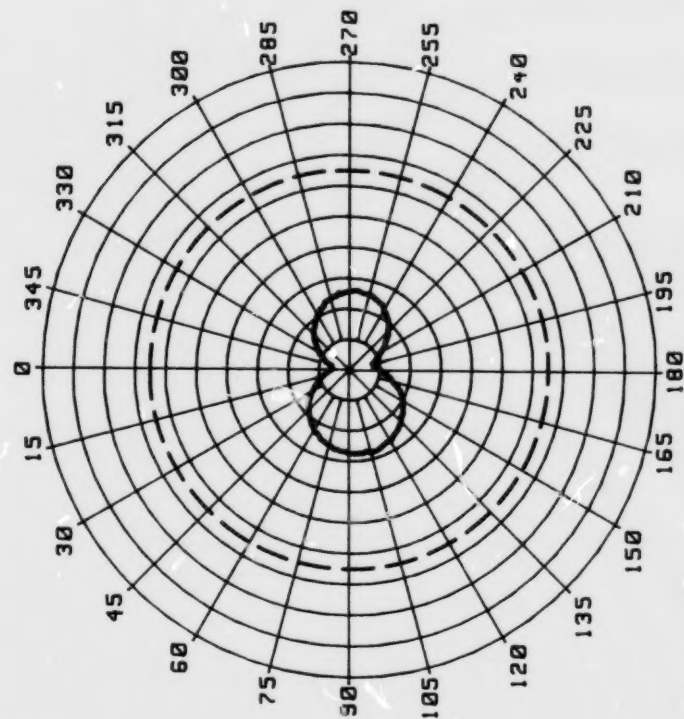
NRC ELECTROMAGNETIC ENGINEERING
13 FEB 1986 15:48:26

COMPILED FROM VOLUME CHS FILE SPECIFIC 4
THE ISOTROPIC LEVEL WAS -1.84 dB
NOTOR F/A

CH-135 MODEL HELICOPTER 48.00 MHz
CH-135 HELICOPTER 2.00 MHz
PITCH PLANE PATTERNS



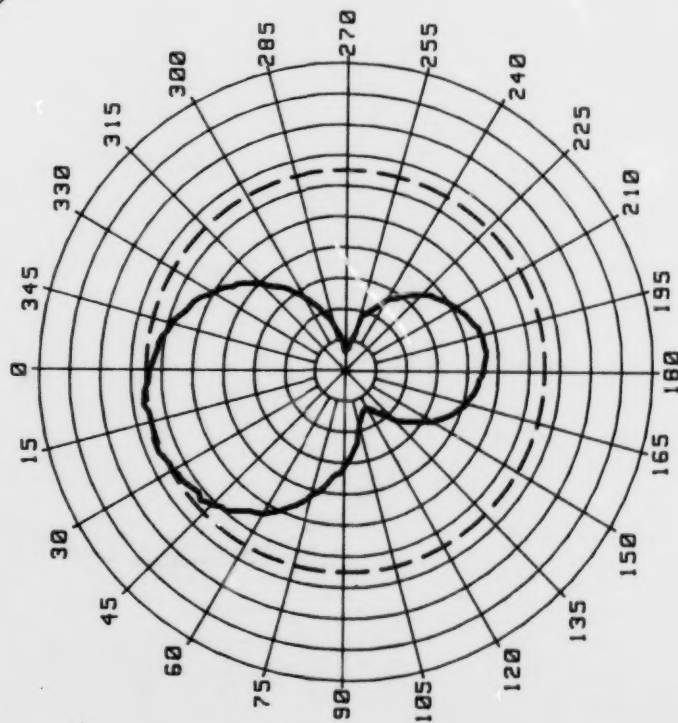
E-THETA



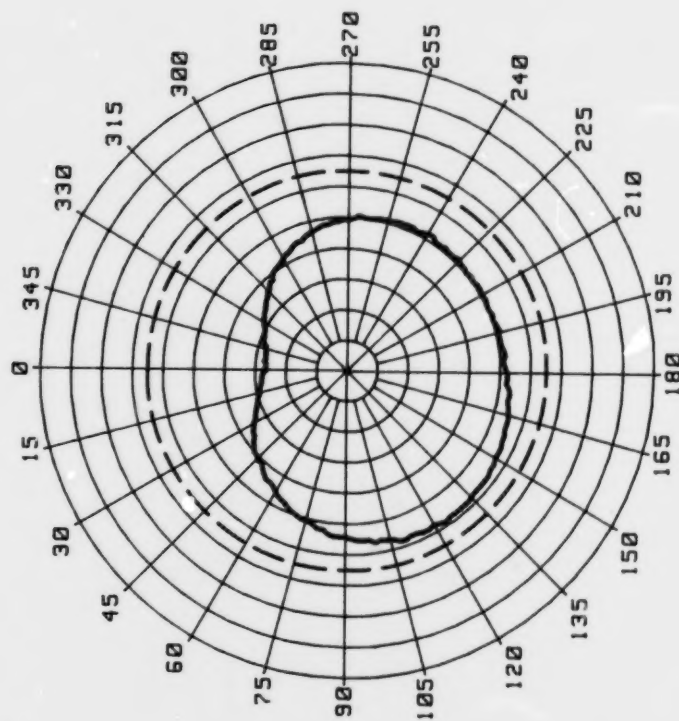
E-PHI

THE FULL-SCALE VALUE IS 1.54 [ISOTROPIC]
--- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 48.00 MHz
CH-135 HELICOPTER 2.00 MHz
YAW PLANE PATTERNS



E-THETA



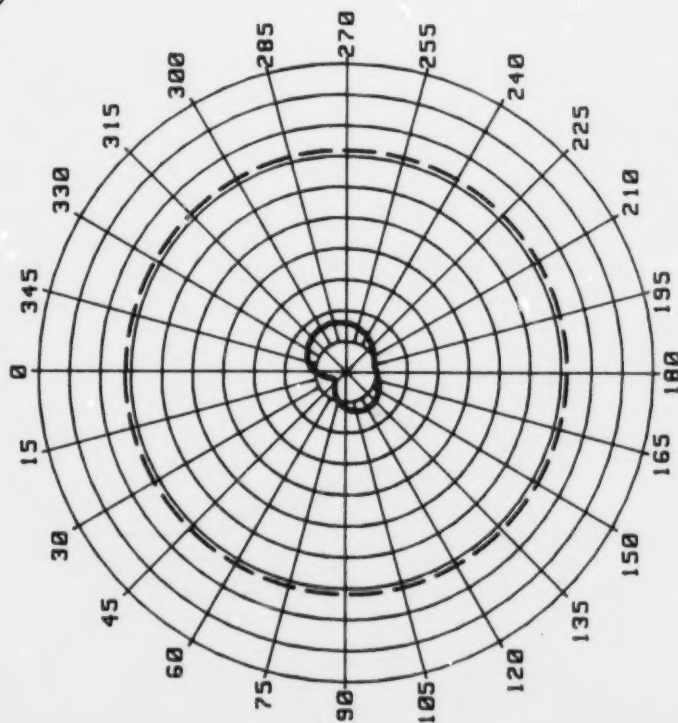
E-PHI

THE FULL-SCALE VALUE IS 1.54 [ISOTROPIC]
--- ISOTROPIC LEVEL

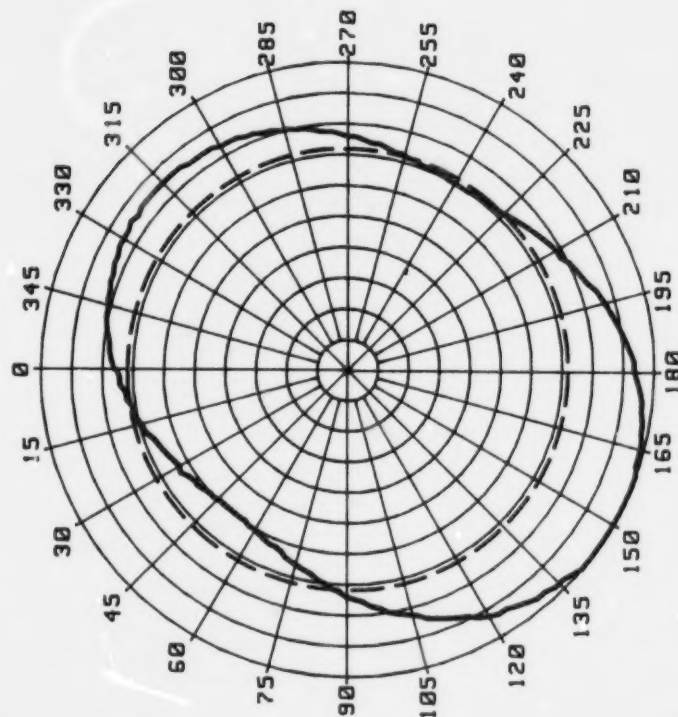
NRC ELECTROMAGNETIC ENGINEERING
13 FEB 1986 15:33:13

COMPILED FROM VOLUME ONE FILE SPECIFIER 6
THE ISOTROPIC LEVEL MNS -8.18 dB
MOTOR F/A

CH-135 MODEL HELICOPTER 72.00 MHz
CH-135 HELICOPTER 3.00 MHz
ROLL PLANE PATTERNS



E-THETA



E-PHI

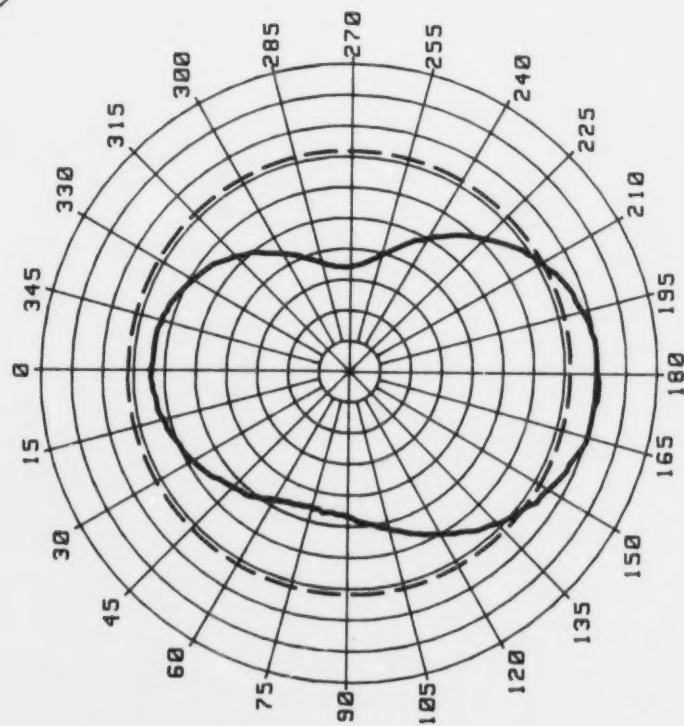
THE FULL-SCALE VALUE IS 1.39 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

NBC ELECTROMAGNETIC ENGINEERING
13 FEB 1986 16:06:51

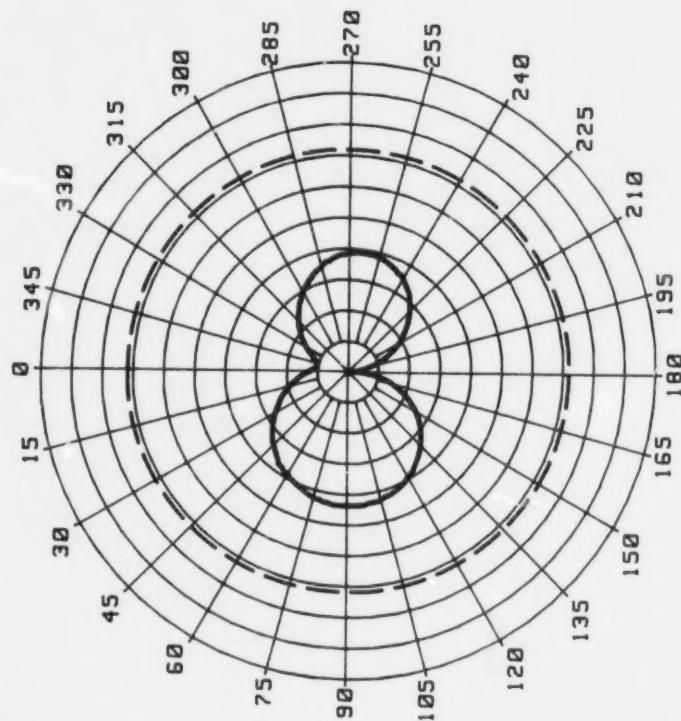
COMPILED FROM VOLUME ONE FILE SPECIFIC 6
THE ISOTROPIC LEVEL WAS -5.18 dB
NOTOR F/A

16

CH-135 MODEL HELICOPTER 72.00 MHz
CH-135 HELICOPTER 3.00 MHz
PITCH PLANE PATTERNS



E-THETA



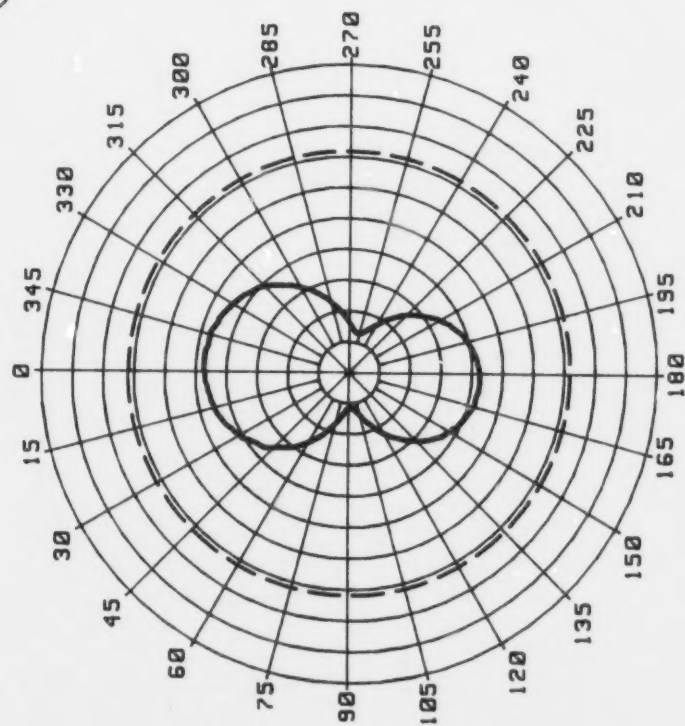
E-PHI

THE FULL-SCALE VALUE IS 1.39 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

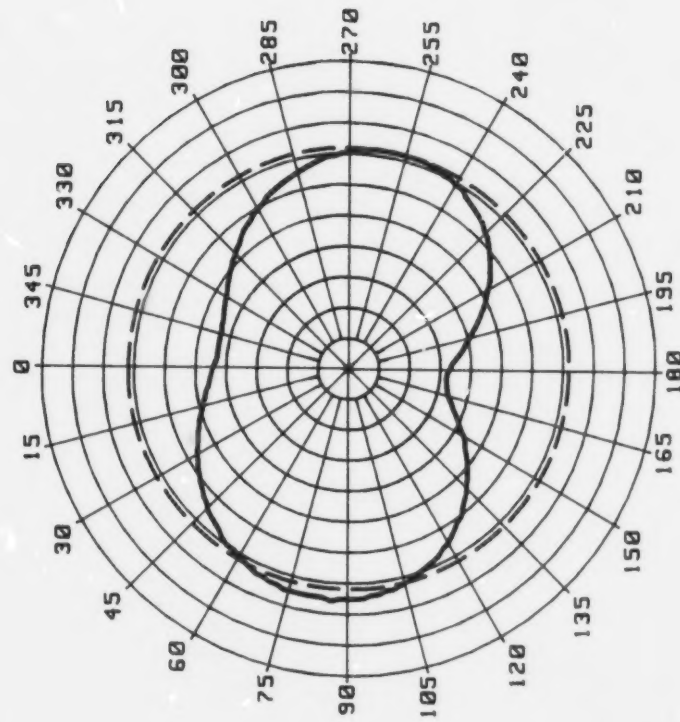
NRC ELECTROMAGNETIC ENGINEERING
 13 FEB 1986 15:47:15

COMPILED FROM VOLUME ONE FILE SPECIFIC 6
 THE ISOTROPIC LEVEL WAS -3.18 dB
 ROTOR F/A

CH-135 MODEL HELICOPTER 72.00 MHz
 CH-135 HELICOPTER 3.00 MHz
 YAW PLANE PATTERNS



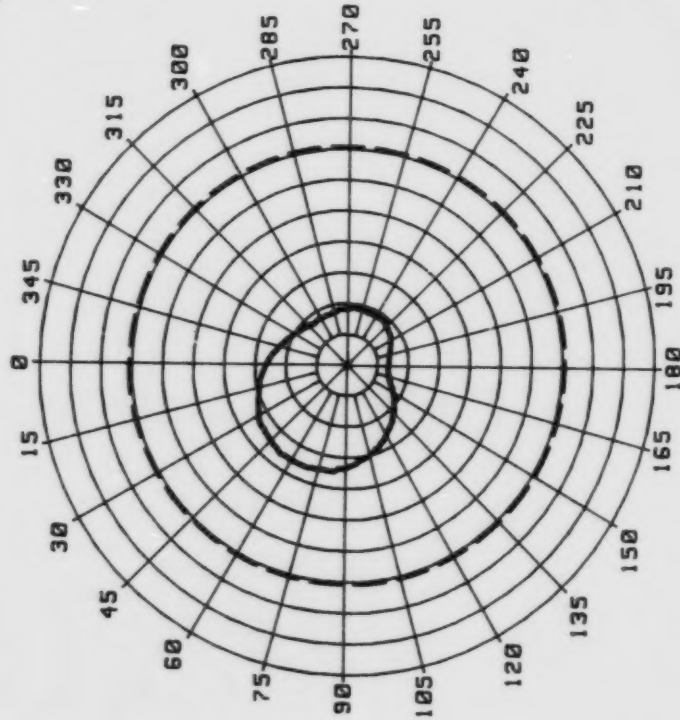
E-THETA



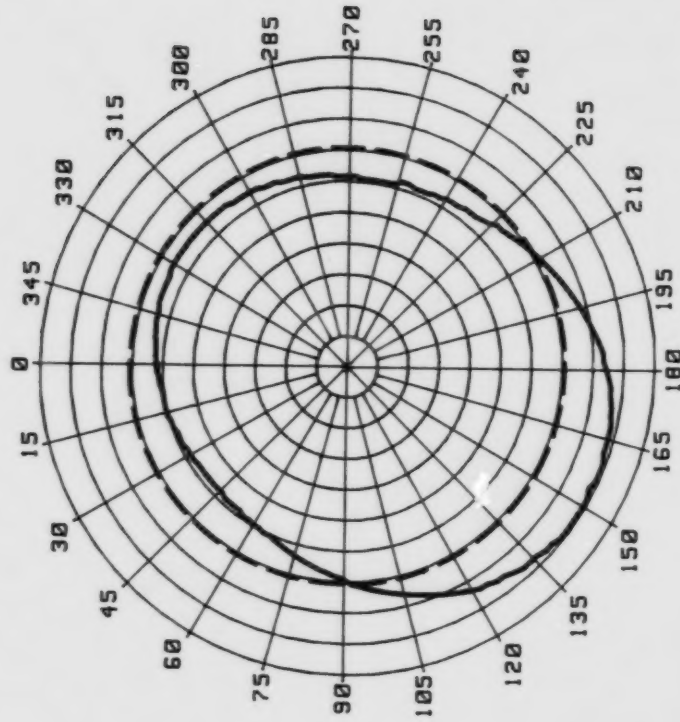
E-PHI

THE FULL-SCALE VALUE IS 1.39 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 92.10 MHz
CH-135 HELICOPTER 3.84 MHz
ROLL PLANE PATTERNS



E-THETA



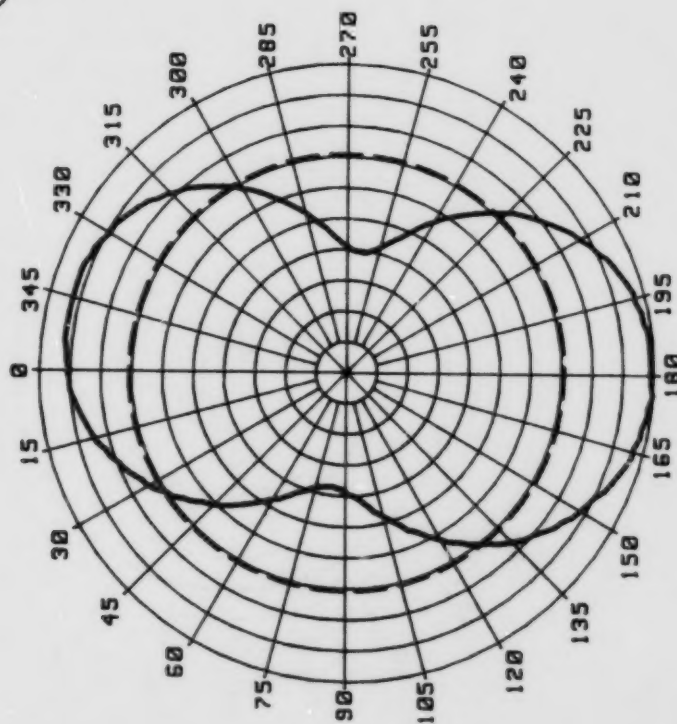
E-PHI

THE FULL-SCALE VALUE IS 1.41 [ISOTROPIC]
---- ISOTROPIC LEVEL

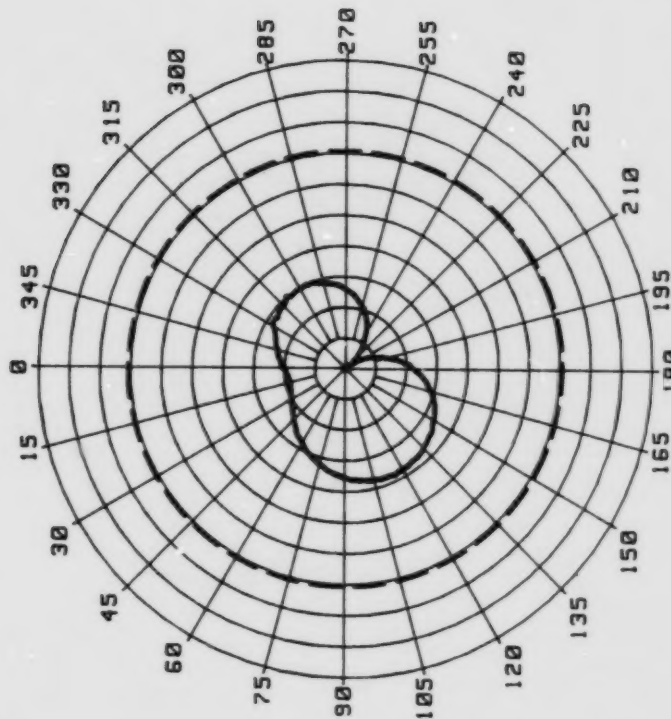
NEC ELECTROMAGNETIC ENGINEERING
13 FEB 1986 16:25:17

COMPILED FROM VOLUME ONE FILE SPECIFIER 7
THE ISOTROPIC LEVEL WAS -4.20 dB
NOTOR F/A

CH-135 MODEL HELICOPTER 92.10 MHz
CH-135 HELICOPTER 3.84 MHz
PITCH PLANE PATTERNS



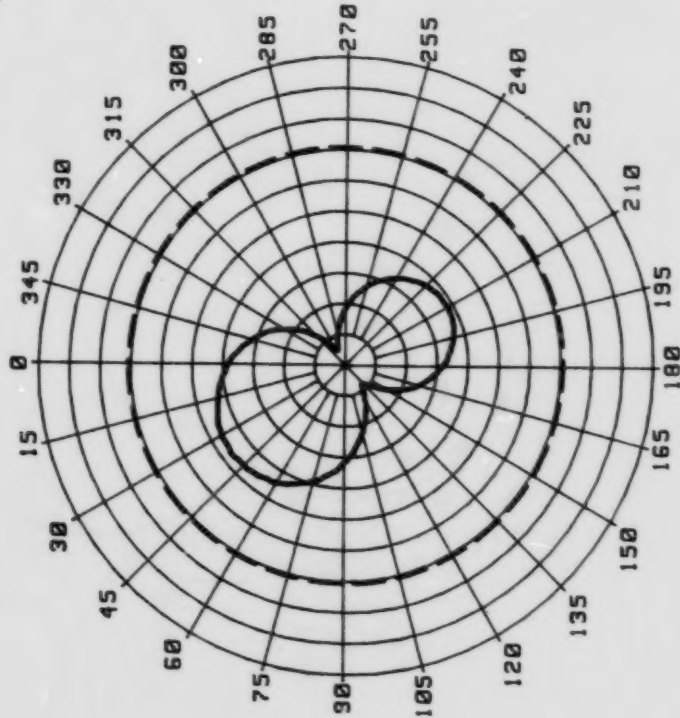
E-THETA



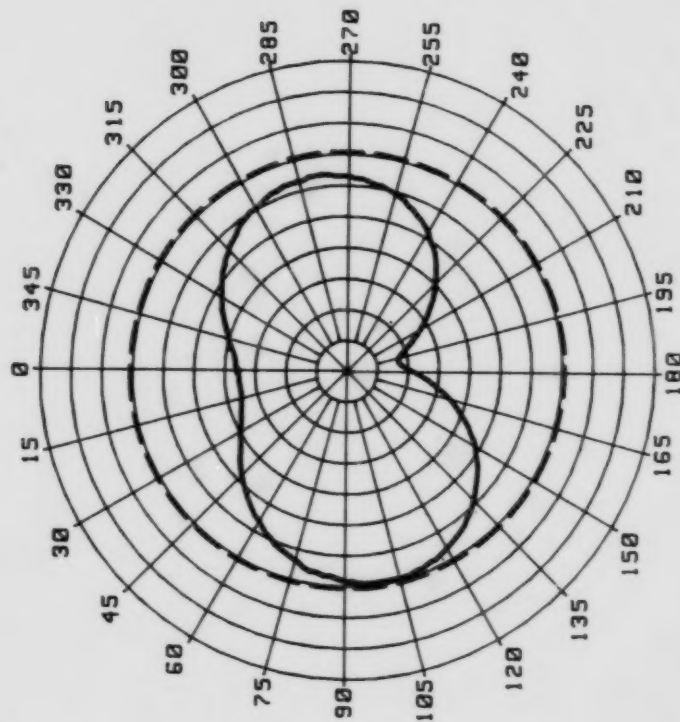
E-PHI

THE FULL-SCALE VALUE IS 1.41 [ISOTROPIC]
--- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 92.10 MHz
 CH-135 HELICOPTER 3.84 MHz
 YAW PLANE PATTERNS



E-THETA



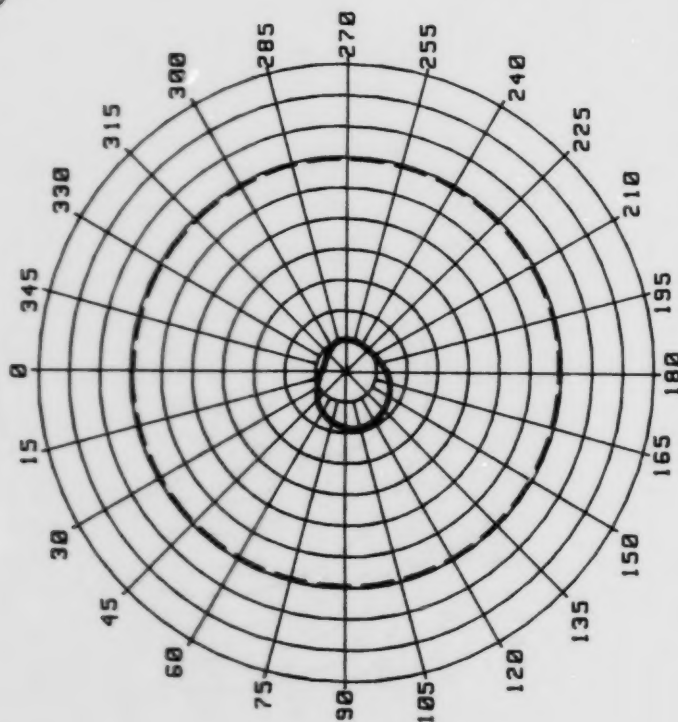
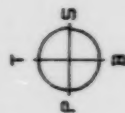
E-PHI

THE FULL-SCALE VALUE IS 1.41 [ISOTROPIC]
 ---- ISOTROPIC LEVEL

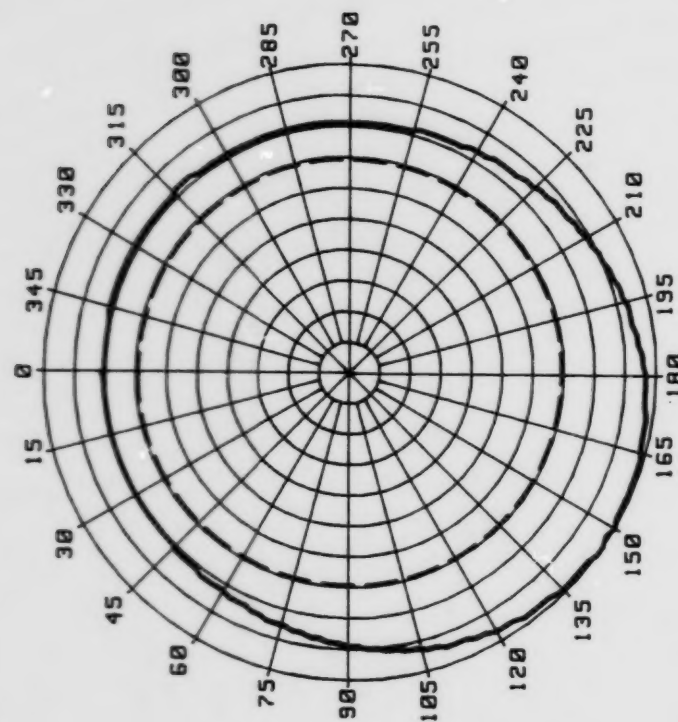
NRC ELECTROMAGNETIC ENGINEERING
13 FEB 1986 16:37:32

COMPILED FROM VOLUME CH1 FILE SPECIFICATION A1
THE ISOTROPIC LEVEL HAS -3.75 dB
NOTION F/A

CH-135 MODEL HELICOPTER 120.00 MHz
CH-135 HELICOPTER 5.00 MHz
ROLL PLANE PATTERNS



E-THETA

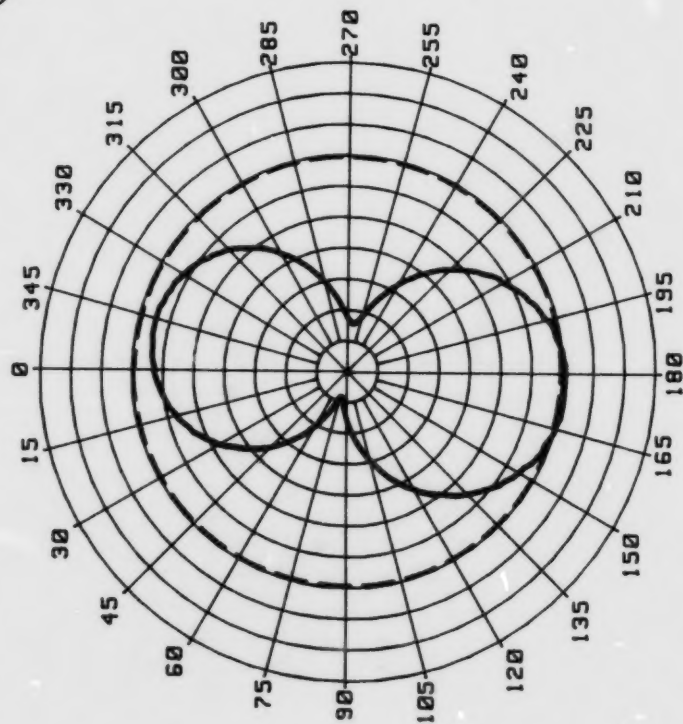


E-PHI

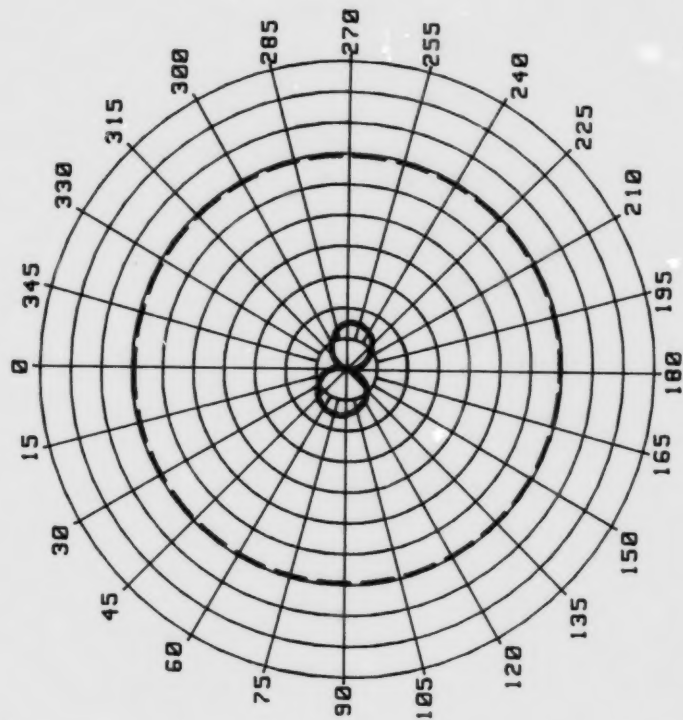
THE FULL-SCALE VALUE IS 1.44 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

COMPILED FROM VOLUME CH1 FILE SPECIFICATION R1
THE ISOTROPIC LEVEL HAS -3.78 dB
NOTOR F/R

CH-135 MODEL HELICOPTER 120.00 MHz
CH-135 HELICOPTER 5.00 MHz
PITCH PLANE PATTERNS



E-THETA



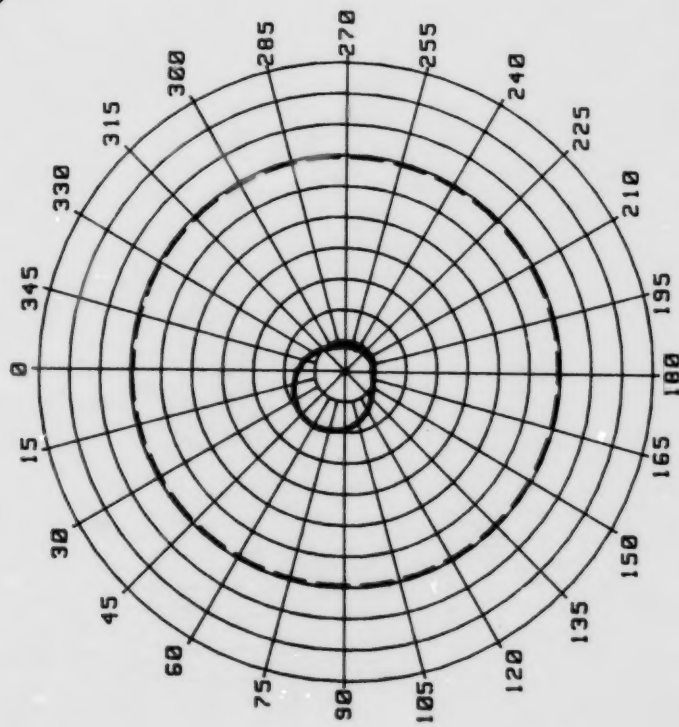
E-PHI

THE FULL-SCALE VALUE IS 1.44 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

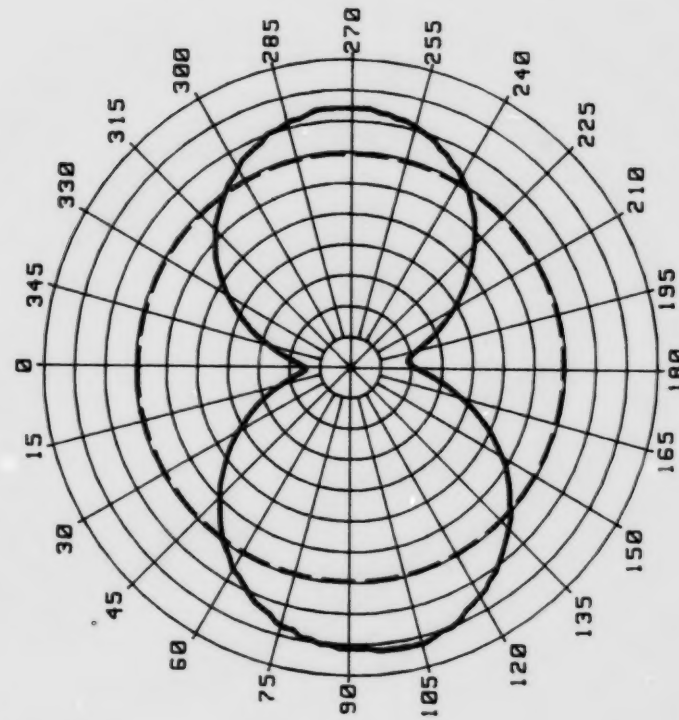
NRC ELECTROMAGNETIC ENGINEERING
19 FEB 1986 16:31:38

COMPILED FROM VOLUME CH1 FILE SPECIFIER R1
THE ISOTROPIC LEVEL WAS -3.75 dB
MOTOR F/M

CH-135 MODEL HELICOPTER 120.00 MHz
CH-135 HELICOPTER 5.00 MHz
YAW PLANE PATTERNS



E-THETA

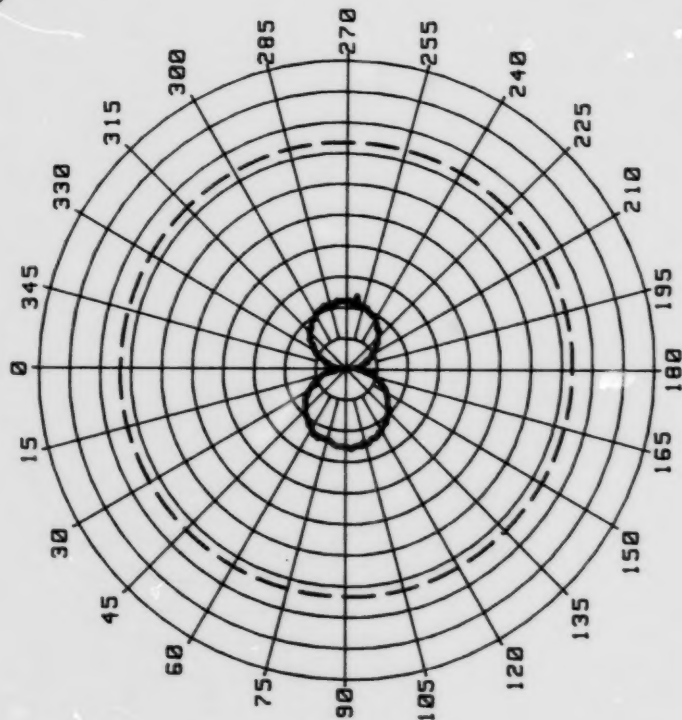
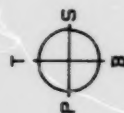


E-PHI

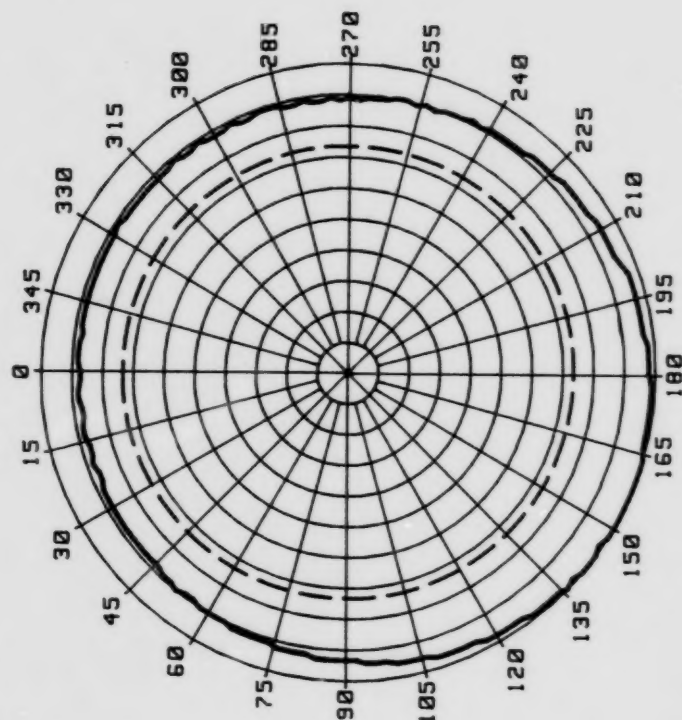
THE FULL-SCALE VALUE IS 1.44 [ISOTROPIC]

--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 144.00 MHz
CH-135 HELICOPTER 6.00 MHz
ROLL PLANE PATTERNS



E-THETA



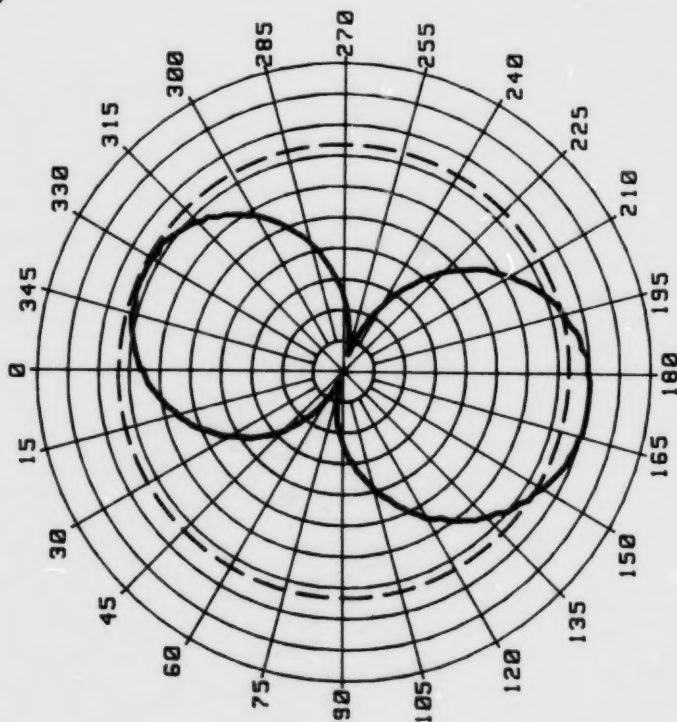
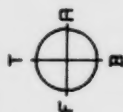
E-PHI

THE FULL-SCALE VALUE IS 1.36 [ISOTROPIC]
--- ISOTROPIC LEVEL

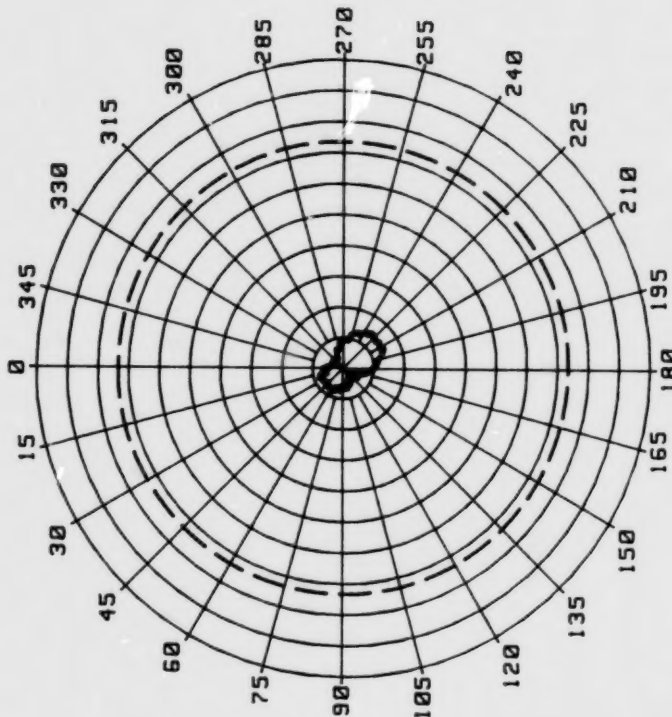
NRC ELECTROMAGNETIC ENGINEERING
14 FEB 1986 00:48:42

COMPILED FROM VOLUME CH-1 FILE SPECIFIER CE
THE ISOTROPIC LEVEL WAS -8.35 dB
ROTOR F/A

CH-135 MODEL HELICOPTER 144.00 MHz
CH-135 HELICOPTER 6.00 MHz
PITCH PLANE PATTERNS



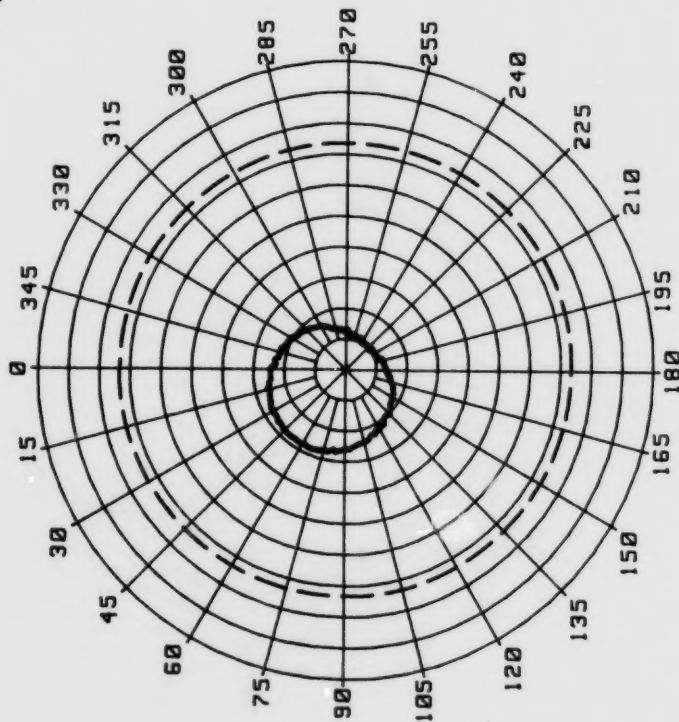
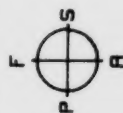
E-THETA



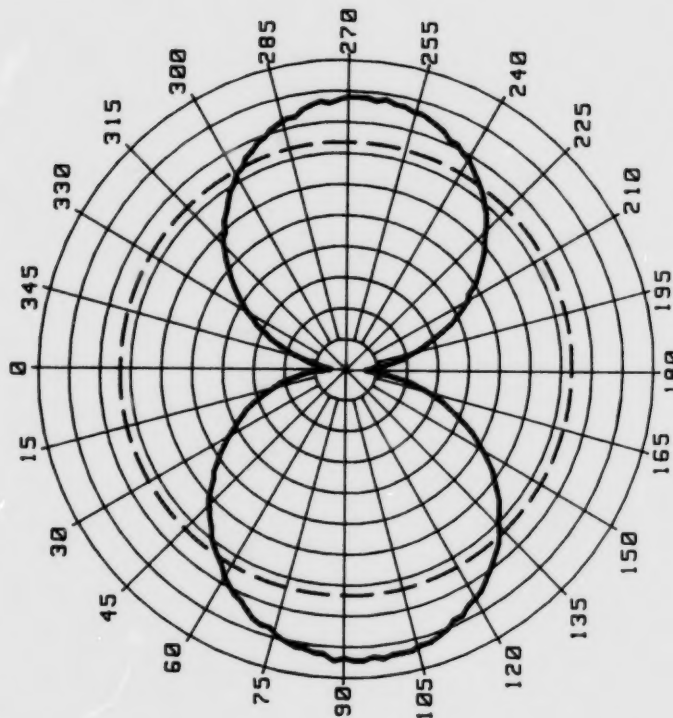
E-PHI

THE FULL-SCALE VALUE IS 1.36 [ISOTROPIC]
--- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 144.00 MHz
CH-135 HELICOPTER 6.00 MHz
YAW PLANE PATTERNS



E-THETA



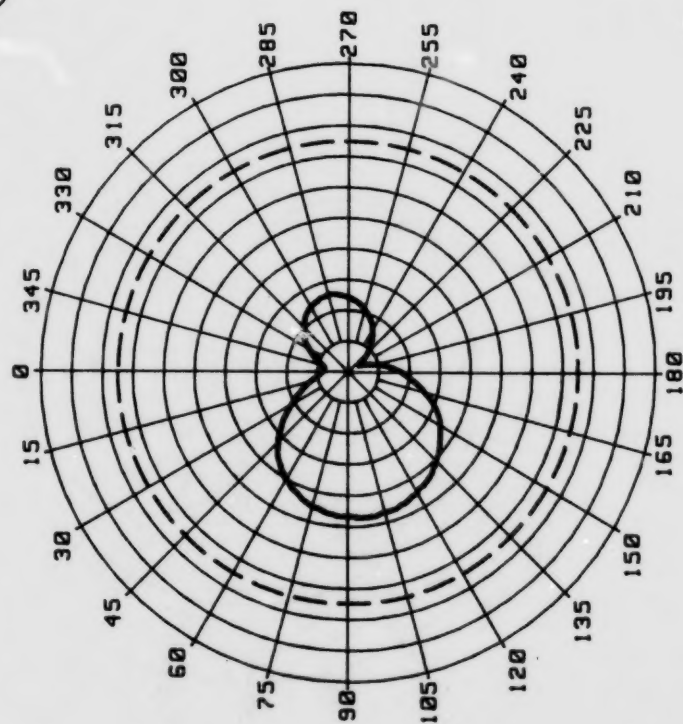
E-PHI

THE FULL-SCALE VALUE IS 1.36 [ISOTROPIC]
--- ISOTROPIC LEVEL

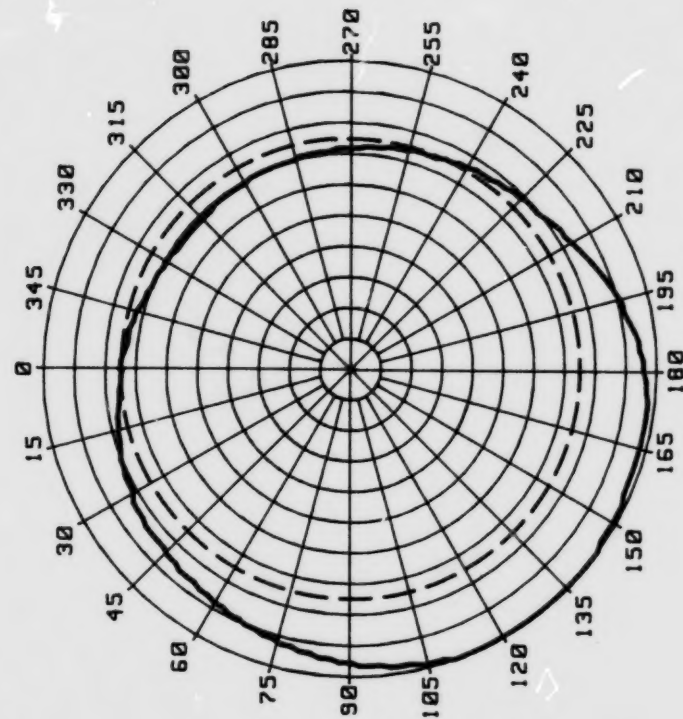
MRC ELECTRONIC ENGINEERING
12 FEB 1986 15:38:29

COMPILED FROM VOLUME ONE FILE SPECIFICATION E3
THE ISOTROPIC LEVEL WAS -1.38 dB
ROTOR F/A

CH-135 MODEL HELICOPTER 168.00 MHz
CH-135 HELICOPTER 7.00 MHz
ROLL PLANE PATTERNS



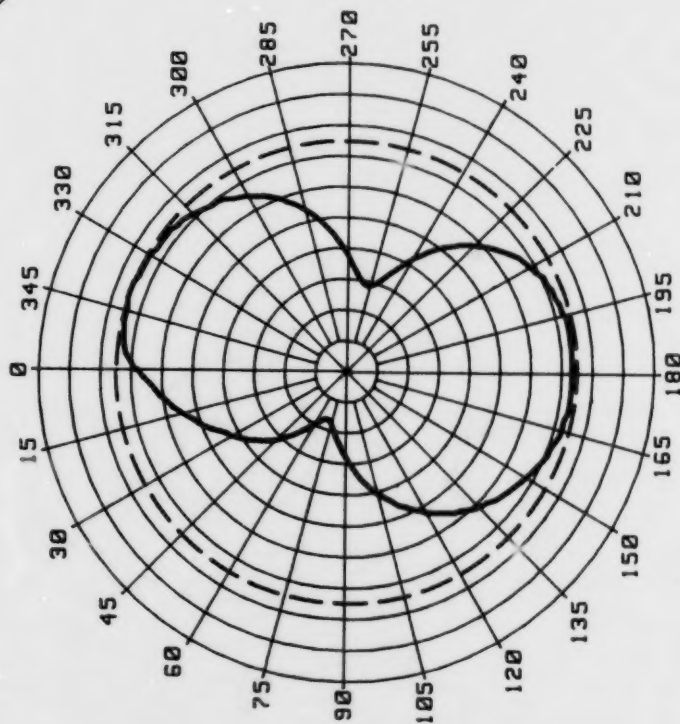
E-THETA



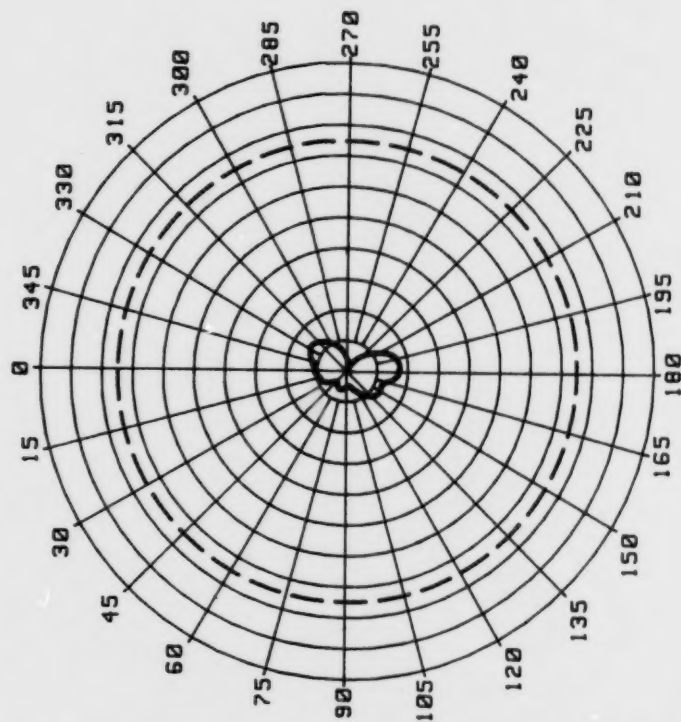
E-PHI

THE FULL-SCALE VALUE IS 1.34 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 168.00 MHz
CH-135 HELICOPTER 7.00 MHz
PITCH PLANE PATTERNS



E-THETA



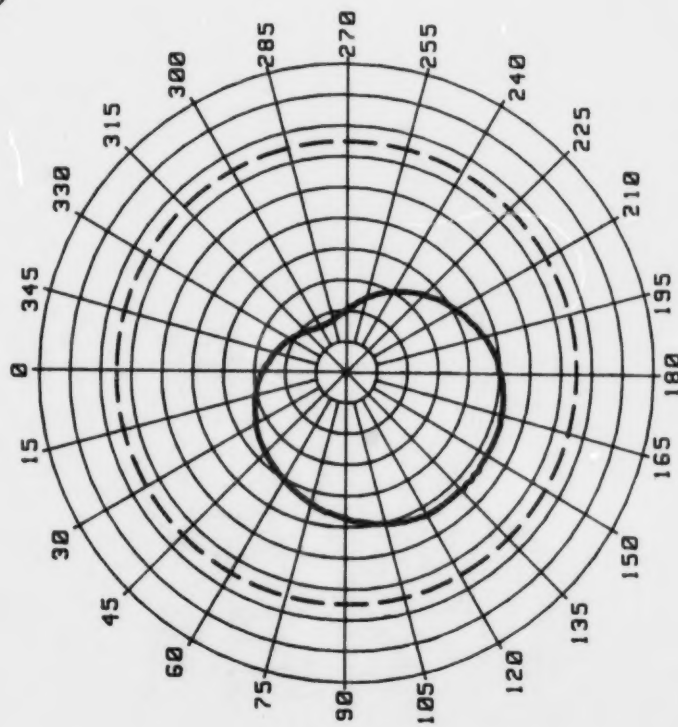
E-PHI

THE FULL-SCALE VALUE IS 1.34 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

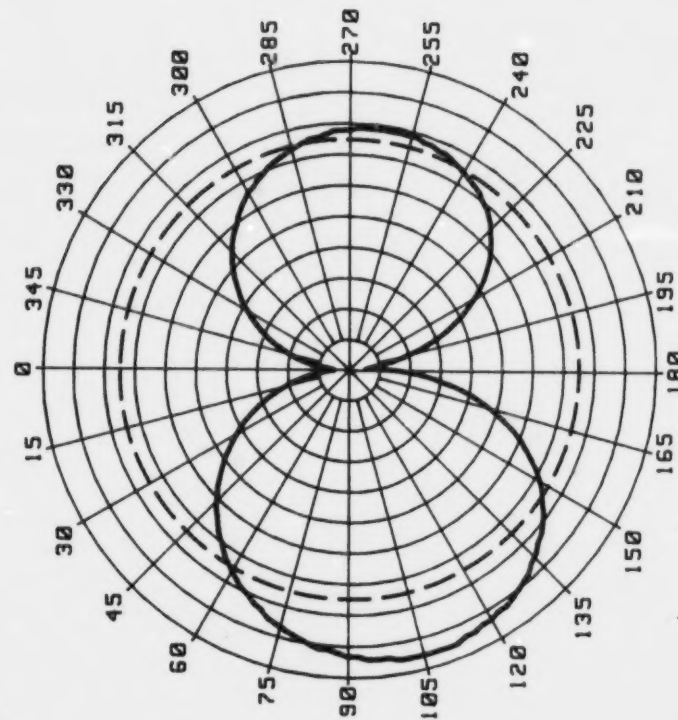
NRC ELECTROMAGNETIC ENGINEERING
 18 FEB 1986 15:24:27

COMPILED FROM VOLUME ONE FILE SPECIFIC C3
 THE ISOTROPIC LEVEL WAS -1.32 dB
 ROTOR F/A

CH-135 MODEL HELICOPTER 168.00 MHz
 CH-135 HELICOPTER 7.00 MHz
 YAW PLANE PATTERNS



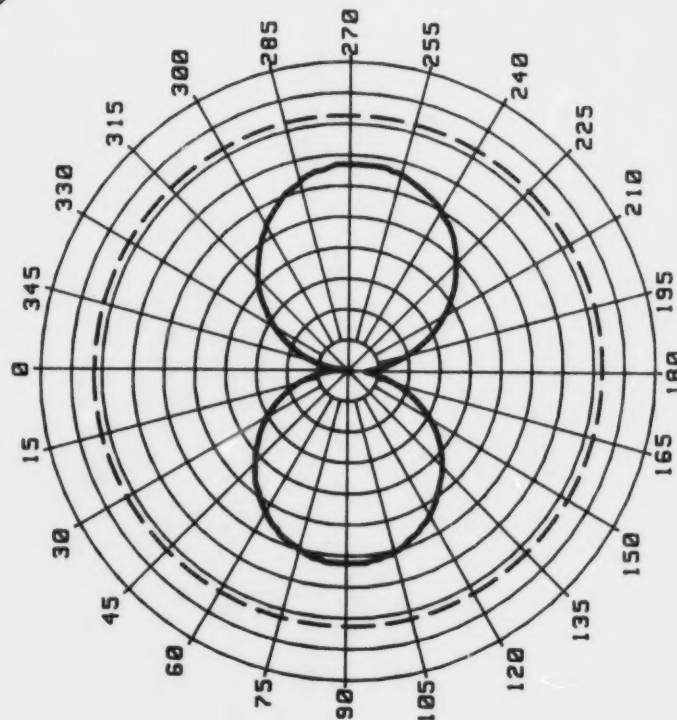
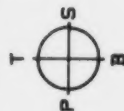
E-THETA



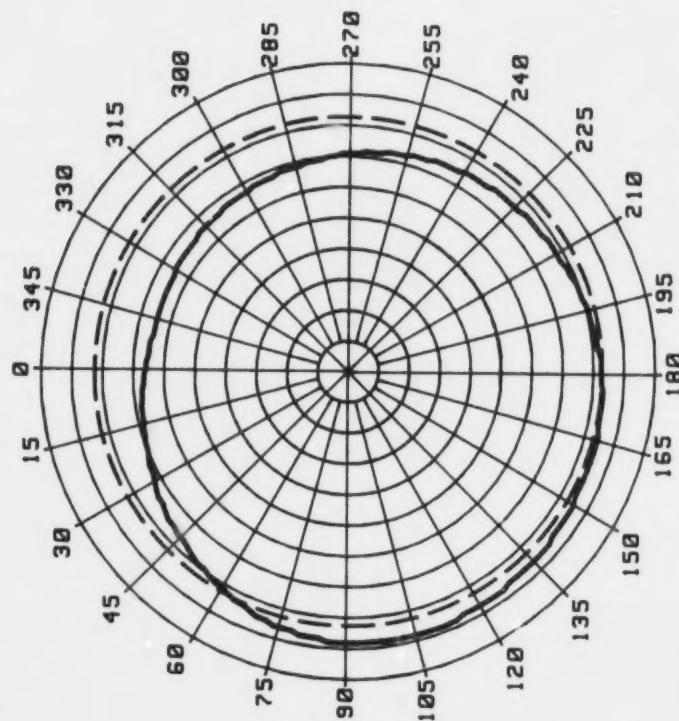
E-PHI

THE FULL-SCALE VALUE IS 1.34 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 192.00 MHz
CH-135 HELICOPTER 8.00 MHz
ROLL PLANE PATTERNS



E-THETA



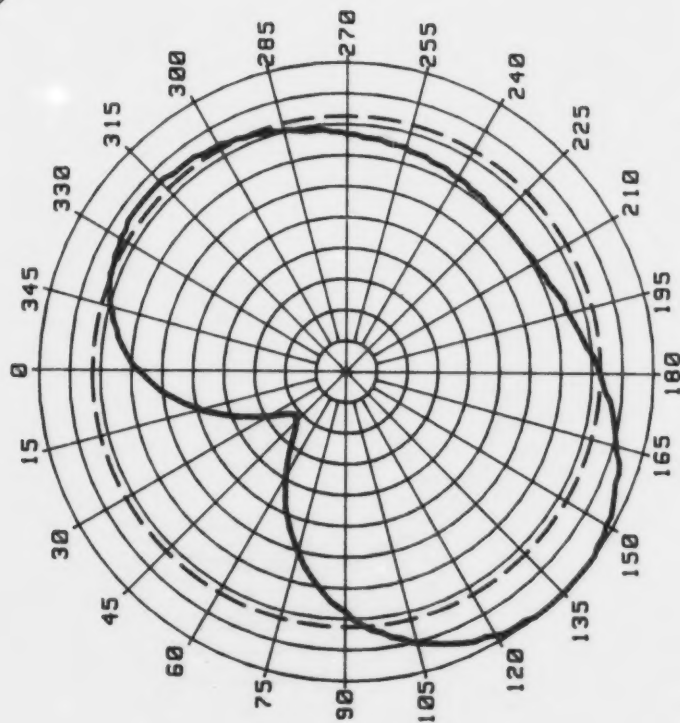
E-PHI

THE FULL-SCALE VALUE IS 1.21 [ISOTROPIC]
--- ISOTROPIC LEVEL

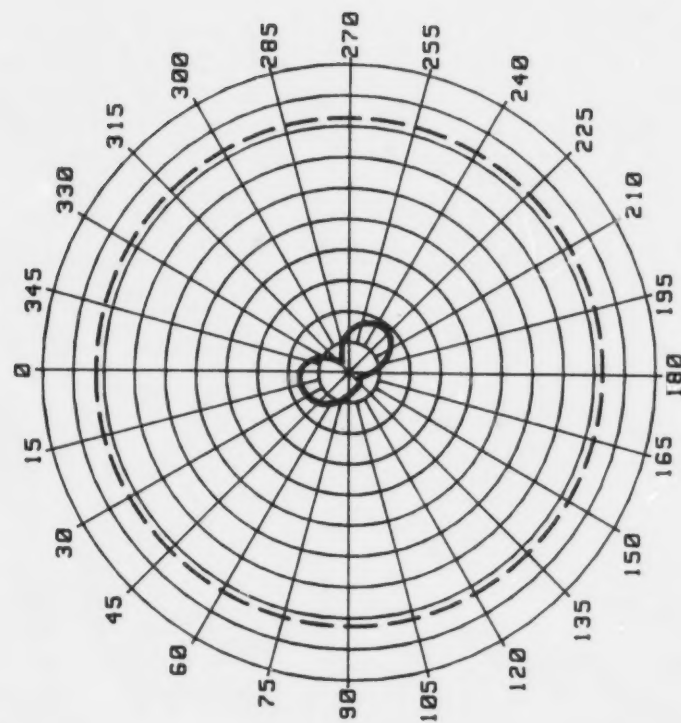
NRC ELECTROMAGNETIC ENGINEERING
21 JUN 1986 18:34:16

COMPILED FROM VOLUME OHS FILE SPECIFIC G
THE ISOTROPIC LEVEL WAS -9.08 dB

CH-135 MODEL HELICOPTER 192.00 MHz
CH-135 HELICOPTER 8.00 MHz
PITCH PLANE PATTERNS



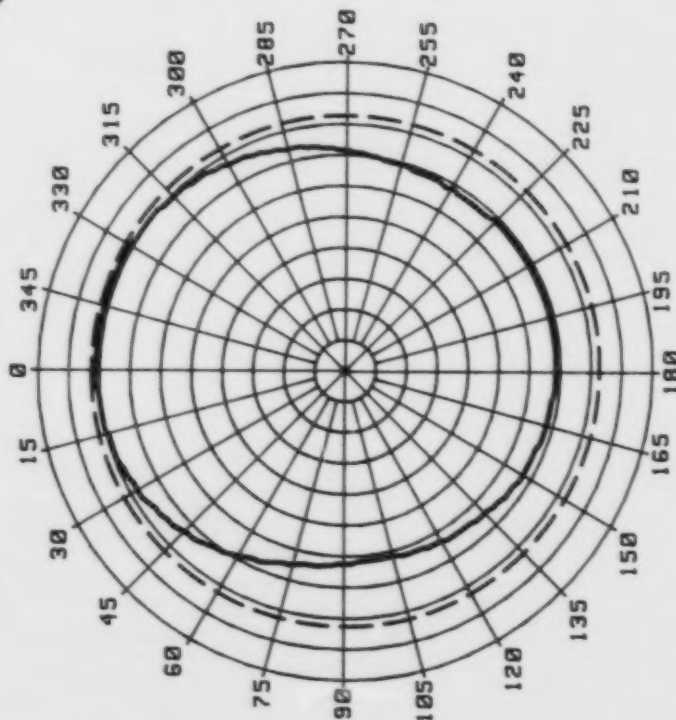
E-THETA



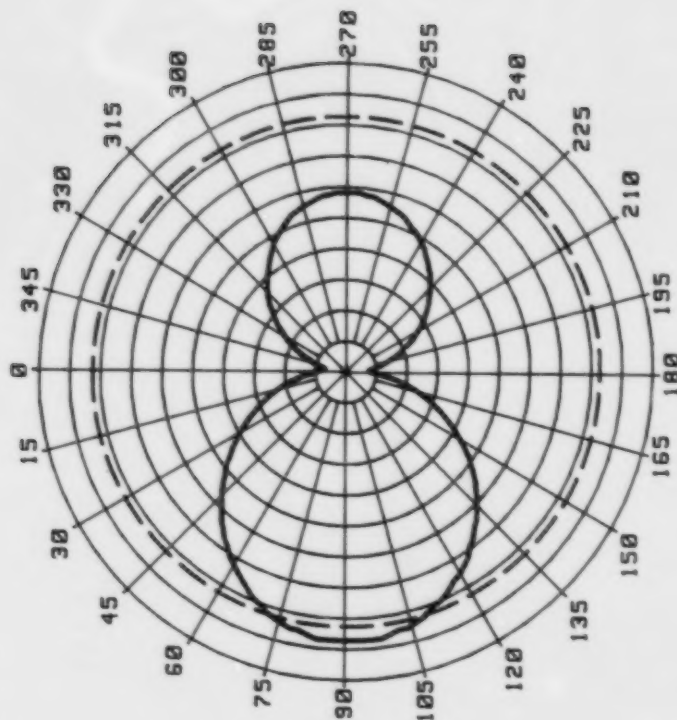
E-PHI

THE FULL-SCALE VALUE IS 1.21 [ISOTROPIC]
--- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 192.00 MHz
CH-135 HELICOPTER 8.00 MHz
YAW PLANE PATTERNS



E-THETA



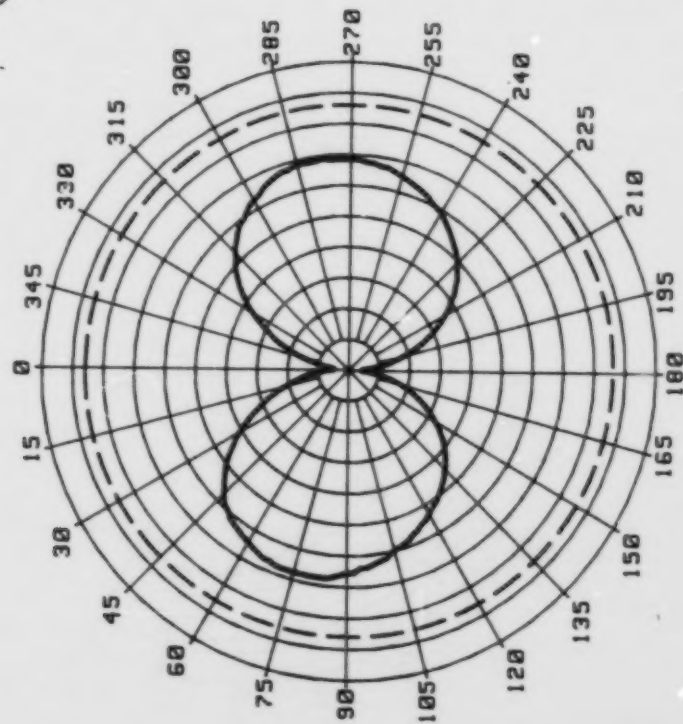
E-PHI

THE FULL-SCALE VALUE IS 1.21 [ISOTROPIC]
--- ISOTROPIC LEVEL

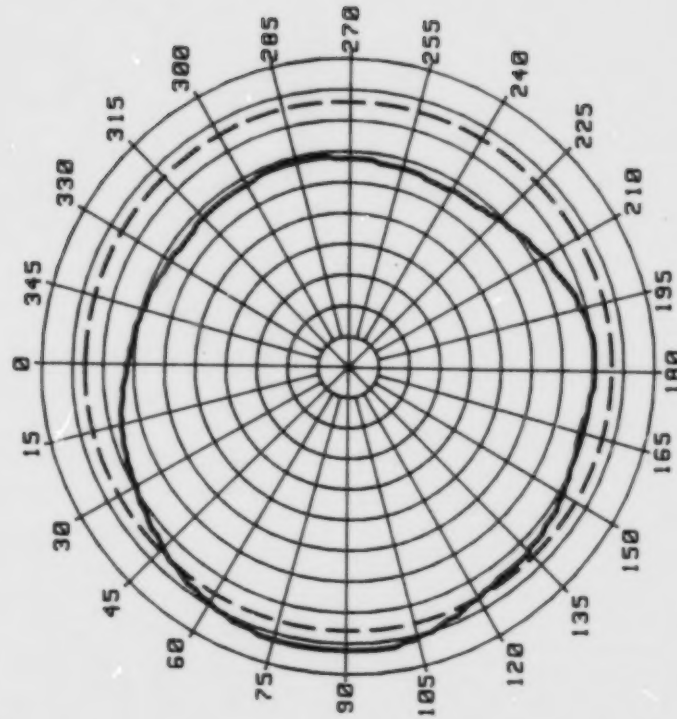
NRC ELECTROMAGNETIC ENGINEERING
21 JAN 1986 18:48:45

COMPILED FROM VOLUME ONE FILE SPECIFIER 12
THE ISOTROPIC LEVEL WAS -3.82 dB

CH-135 MODEL HELICOPTER 216.00 MHz
CH-135 HELICOPTER 9.00 MHz
ROLL PLANE PATTERNS



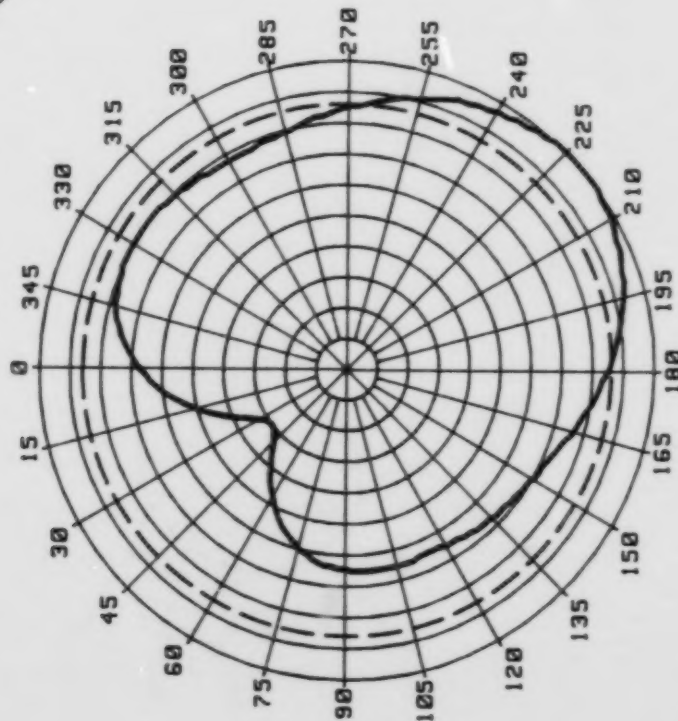
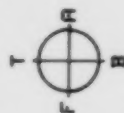
E-THETA



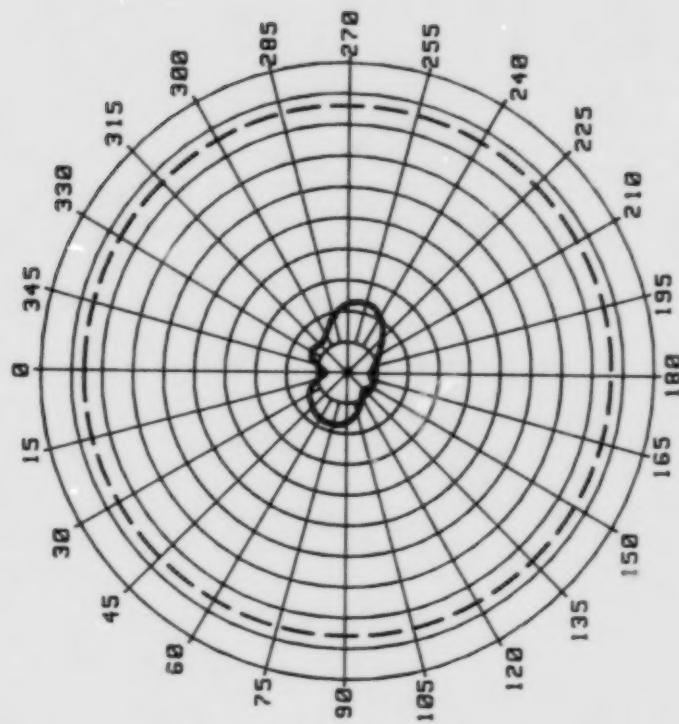
E-PHI

THE FULL-SCALE VALUE IS 1.16 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 216.00 MHz
CH-135 HELICOPTER 9.00 MHz
PITCH PLANE PATTERNS



E-THETA



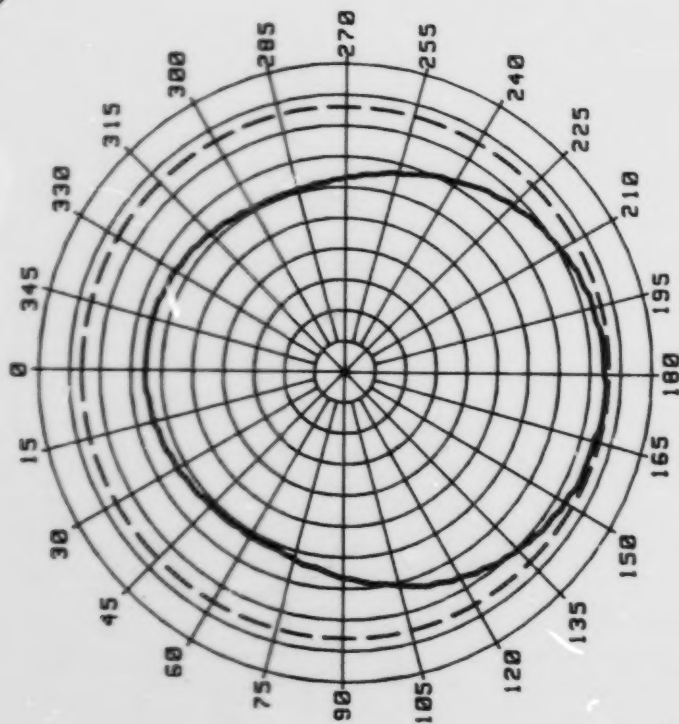
E-PHI

THE FULL-SCALE VALUE IS 1.16 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

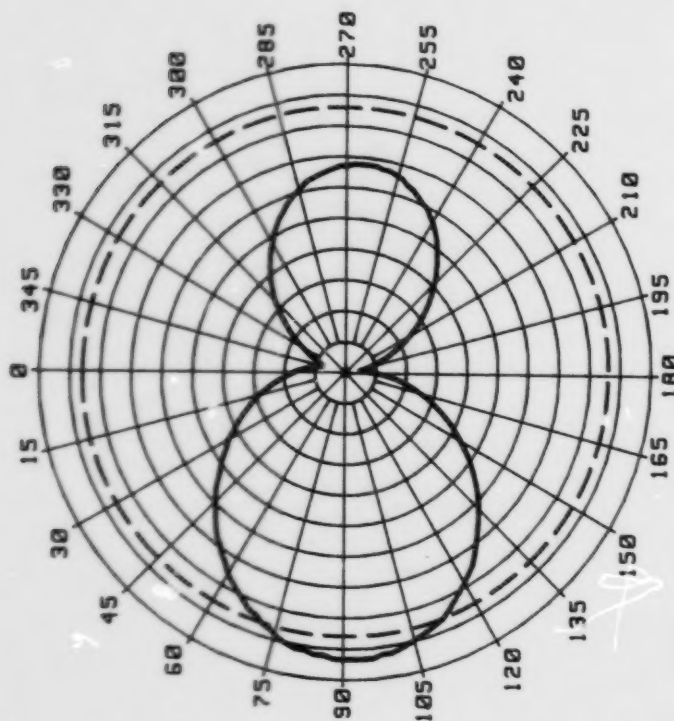
HRC ELECTROMAGNETIC ENGINEERING
21 JAN 1986 10:42:28

COMPILED FROM VOLUME ONE FILE SPECIFICATION 12
THE ISOTROPIC LEVEL HAS -3.02 dB

CH-135 MODEL HELICOPTER 216.00 MHz
CH-135 HELICOPTER 9.00 MHz
YAW PLANE PATTERNS



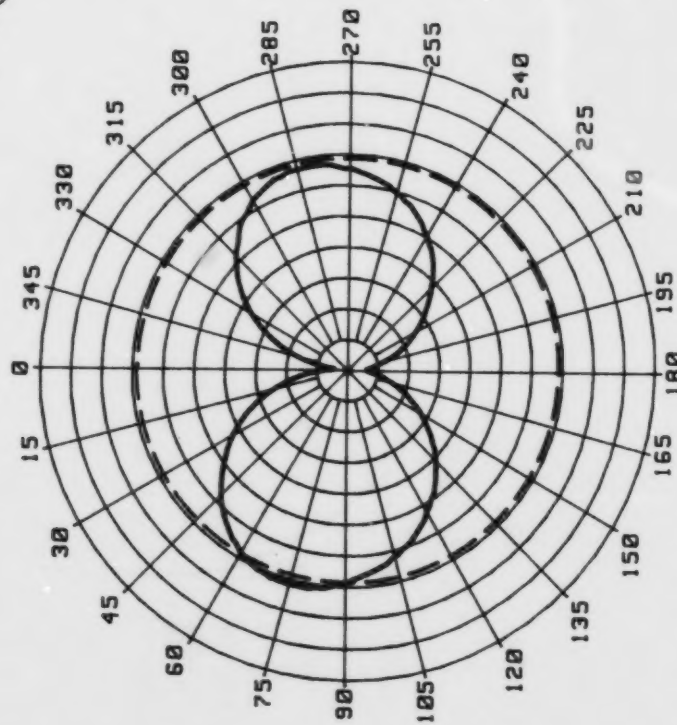
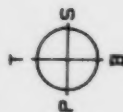
E-THETA



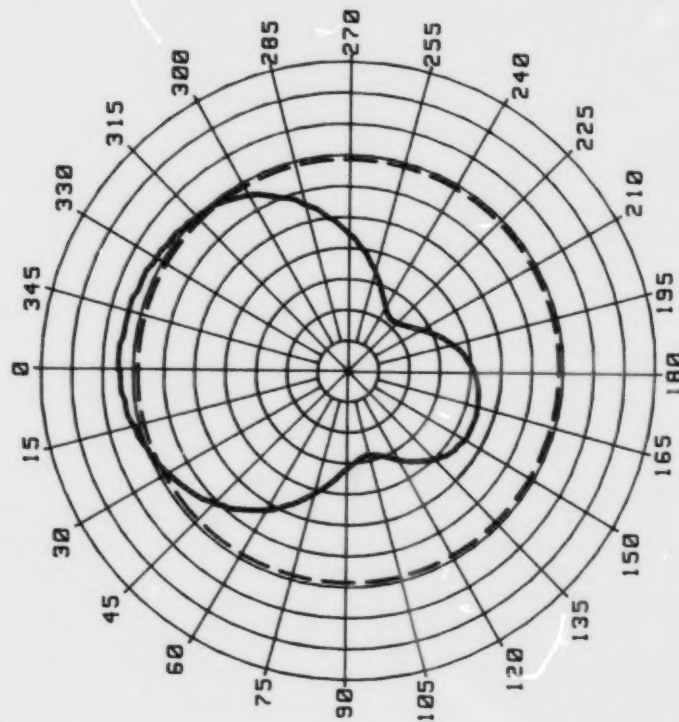
E-PHI

THE FULL-SCALE VALUE IS 1.16 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 240.00 MHz
 CH-135 HELICOPTER 10.00 MHz
 ROLL PLANE PATTERNS



E-THETA



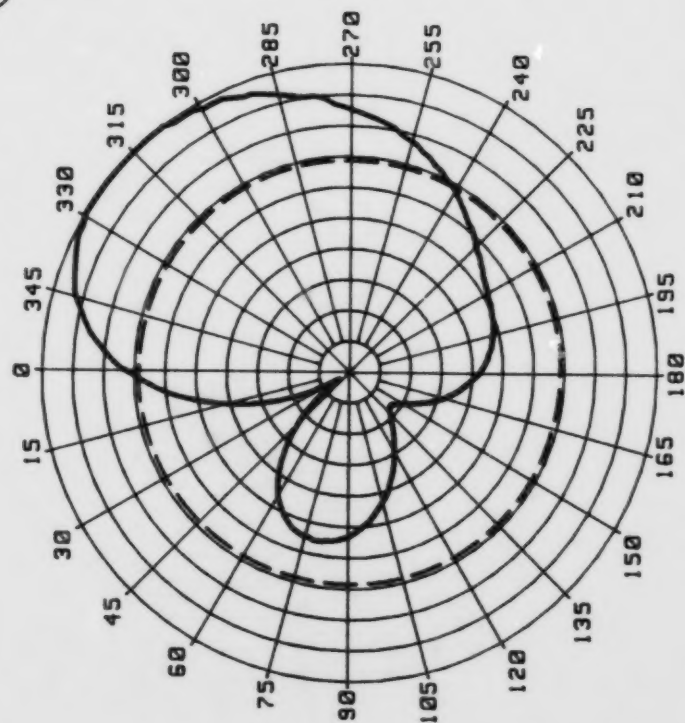
E-PHI

THE FULL-SCALE VALUE IS 1.46 [ISOTROPIC]
 --- ISOTROPIC LEVEL

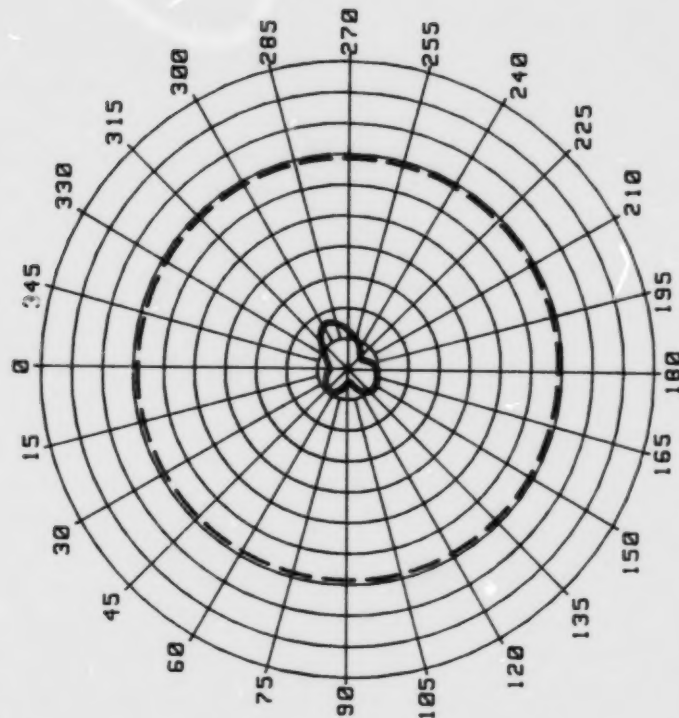
NRC ELECTROMAGNETIC ENGINEERING
 21 JAN 1986 11:15:47

COMPILED FROM VOLUME CH18 FILE SPECIFIER K
 THE ISOTROPIC LEVEL WAS -18.00 dB

CH-135 MODEL HELICOPTER 240.00 MHz
 CH-135 HELICOPTER 10.00 MHz
 PITCH PLANE PATTERNS



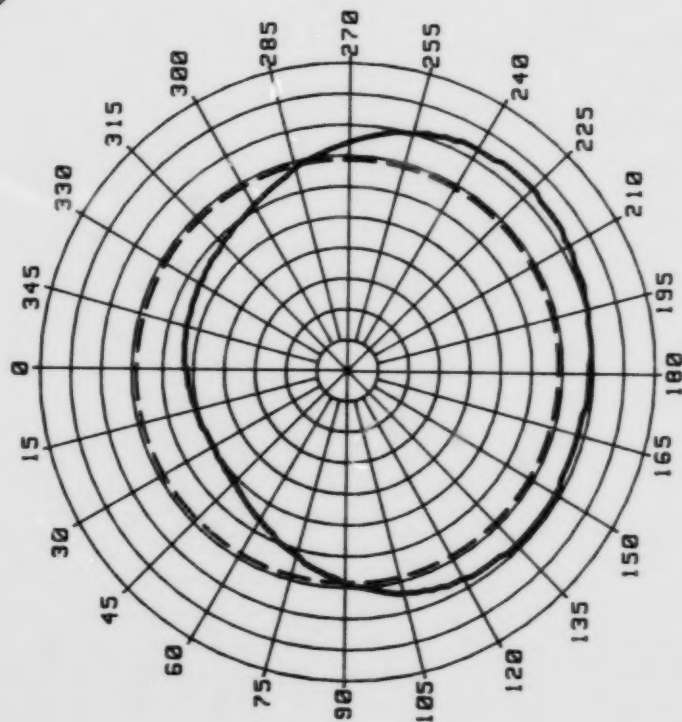
E-THETA



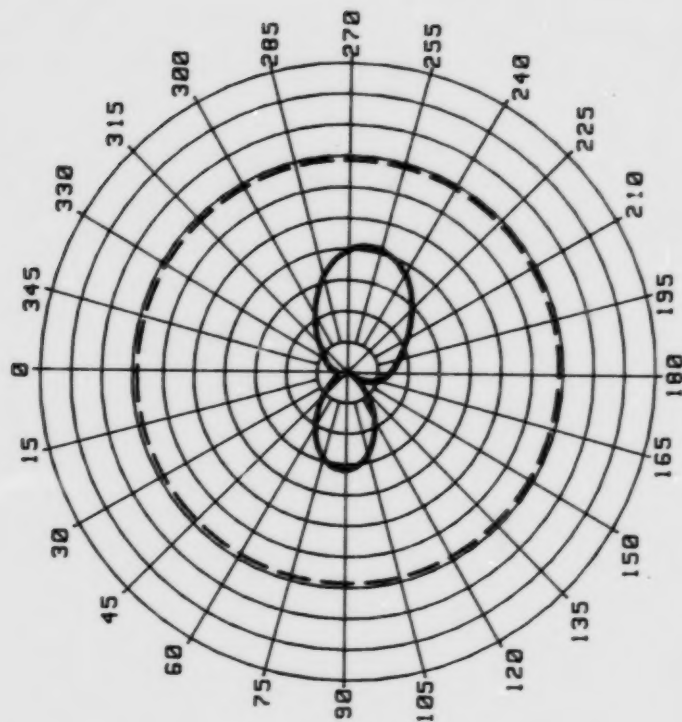
E-PHI

THE FULL-SCALE VALUE IS 1.46 [ISOTROPIC]
 --- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 240.00 MHz
CH-135 HELICOPTER 10.00 MHz
YAW PLANE PATTERNS



E-THETA



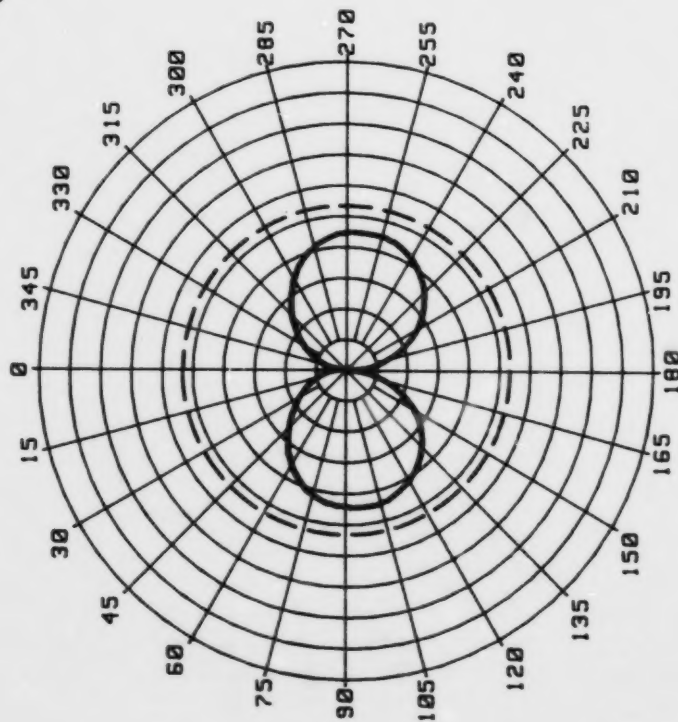
E-PHI

THE FULL-SCALE VALUE IS 1.46 [ISOTROPIC]
--- ISOTROPIC LEVEL

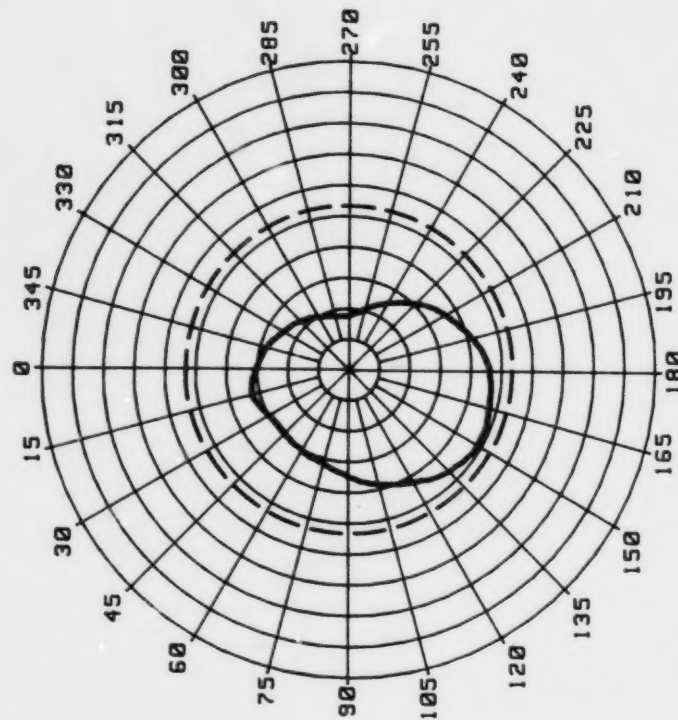
NRC ELECTROMAGNETIC ENGINEERING
21 JUN 1986 11:20:15

COMPILED FROM VOLUME CM7 FILE SPECIFIER N
THE ISOTROPIC LEVEL WAS -6.17 dB

CH-135 MODEL HELICOPTER 264.00 MHz
CH-135 HELICOPTER 11.00 MHz
ROLL PLANE PATTERNS



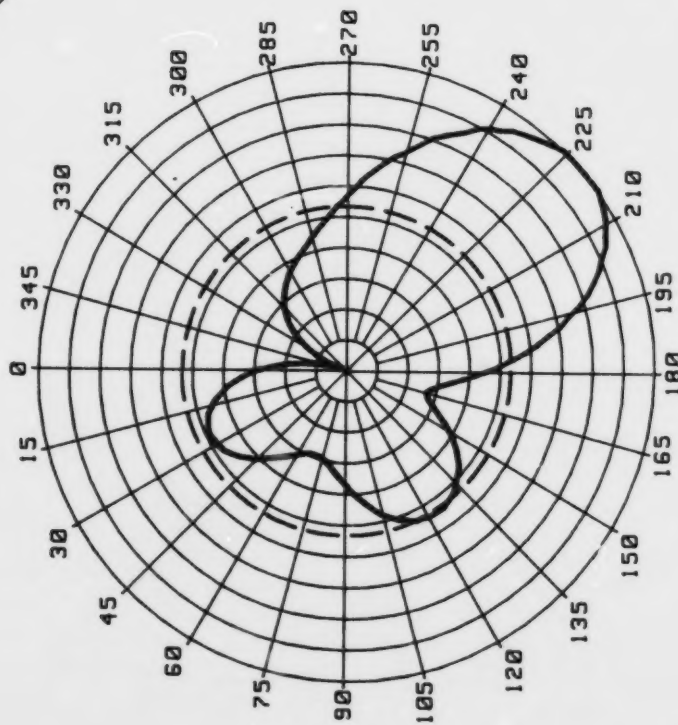
E-THETA



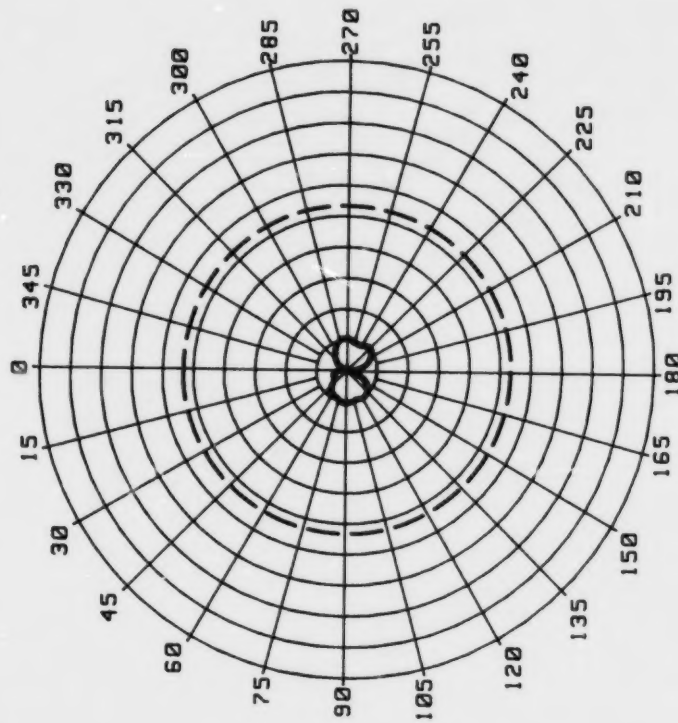
E-PHI

THE FULL-SCALE VALUE IS 1.88 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 264.00 MHz
CH-135 HELICOPTER 11.00 MHz
PITCH PLANE PATTERNS



E-THETA



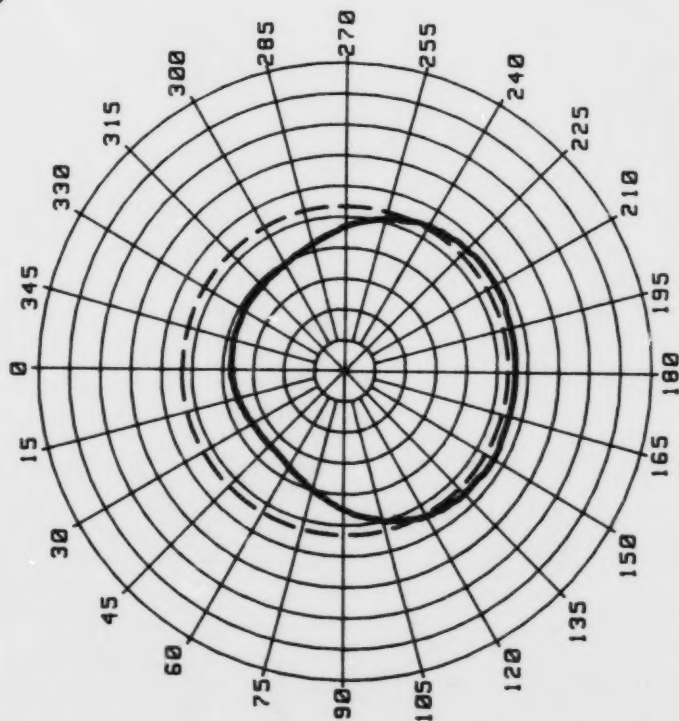
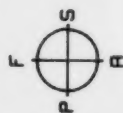
E-PHI

THE FULL-SCALE VALUE IS 1.88 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

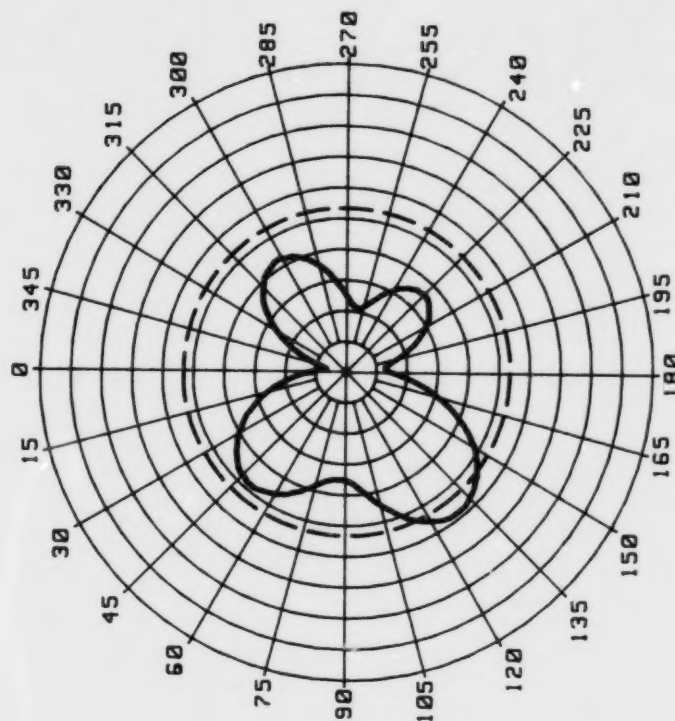
NRC ELECTROMAGNETIC ENGINEERING
21 JAN 1986 11:22:28

COMPILED FROM VOLUME CH7 FILE SPECIFICATION H
THE ISOTROPIC LEVEL WAS -6.17 dB

CH-135 MODEL HELICOPTER 264.00 MHz CH-135 HELICOPTER 11.00 MHz YAW PLANE PATTERNS



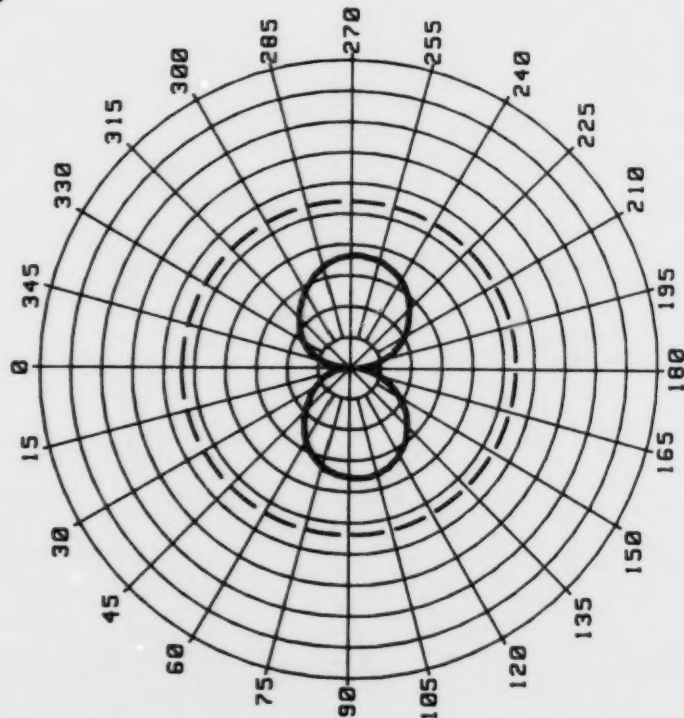
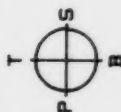
E-THETA



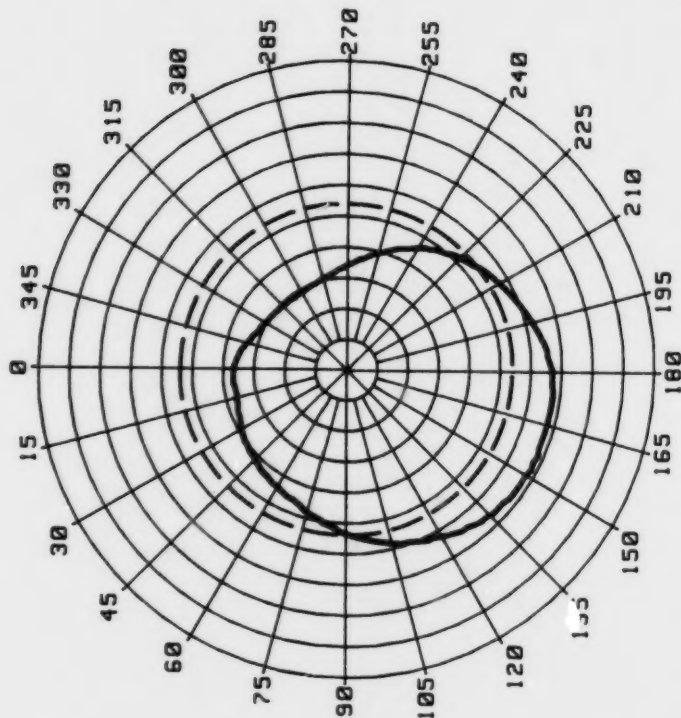
E-PHI

THE FULL-SCALE VALUE IS 1.88 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 288.00 MHz
 CH-135 HELICOPTER 12.00 MHz
 ROLL PLANE PATTERNS



E-THETA



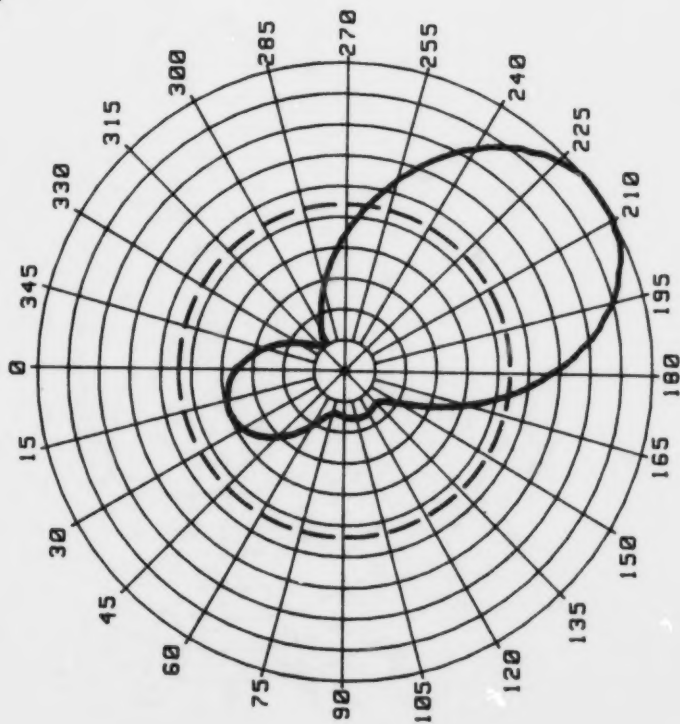
E-PHI

THE FULL-SCALE VALUE IS 1.86 [ISOTROPIC]
 ---- ISOTROPIC LEVEL

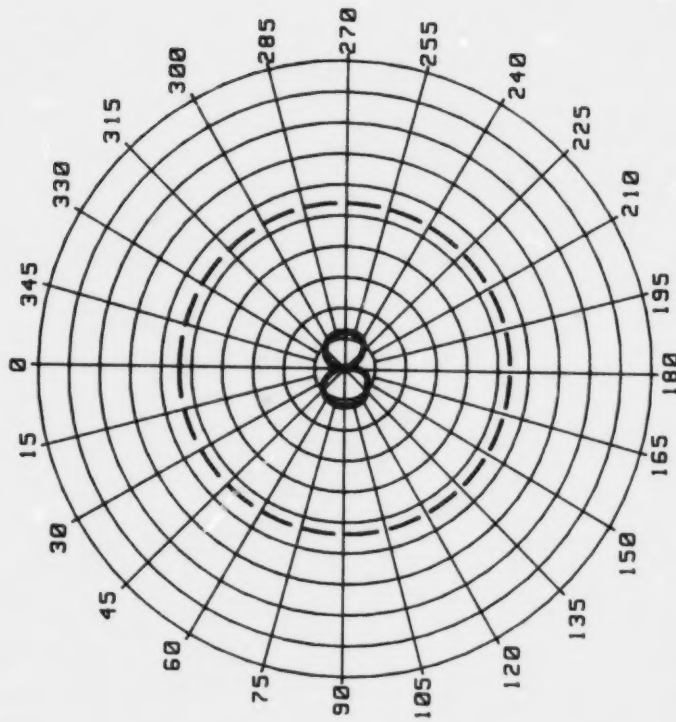
NBC ELECTROMAGNETIC ENGINEERING
21 JAN 1986 11:58:42

COMPILED FROM VOLUME CH12 FILE SPECIFIER 0
THE ISOTROPIC LEVEL WAS -18.17 dB

CH-135 MODEL HELICOPTER 288.00 MHz
CH-135 HELICOPTER 12.00 MHz
PITCH PLANE PATTERNS



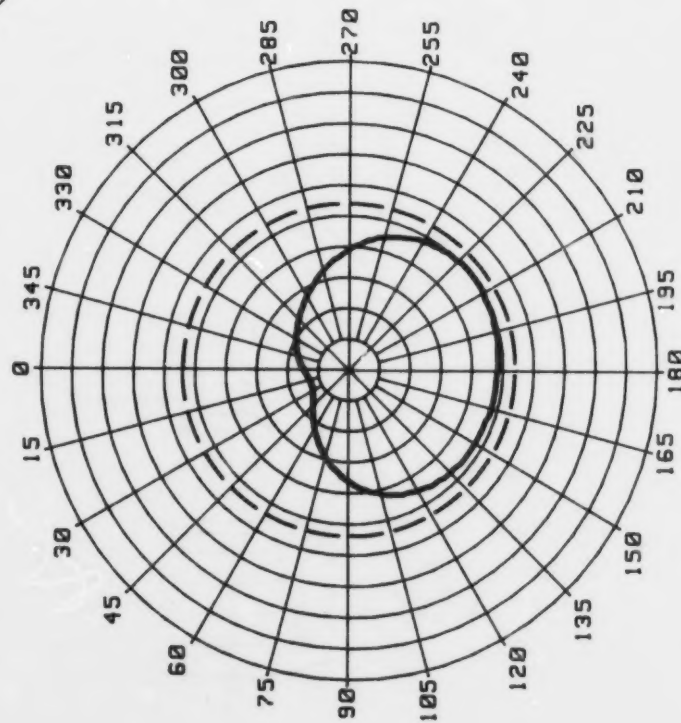
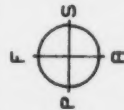
E-THETA



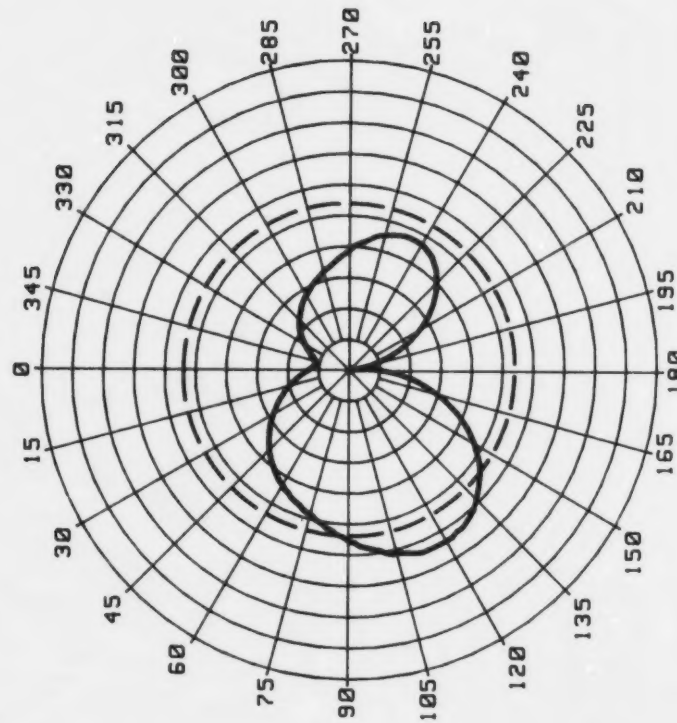
E-PHI

THE FULL-SCALE VALUE IS 1.86 [ISOTROPIC]
--- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 288.00 MHz
CH-135 HELICOPTER 12.00 MHz
YAW PLANE PATTERNS



E-THETA



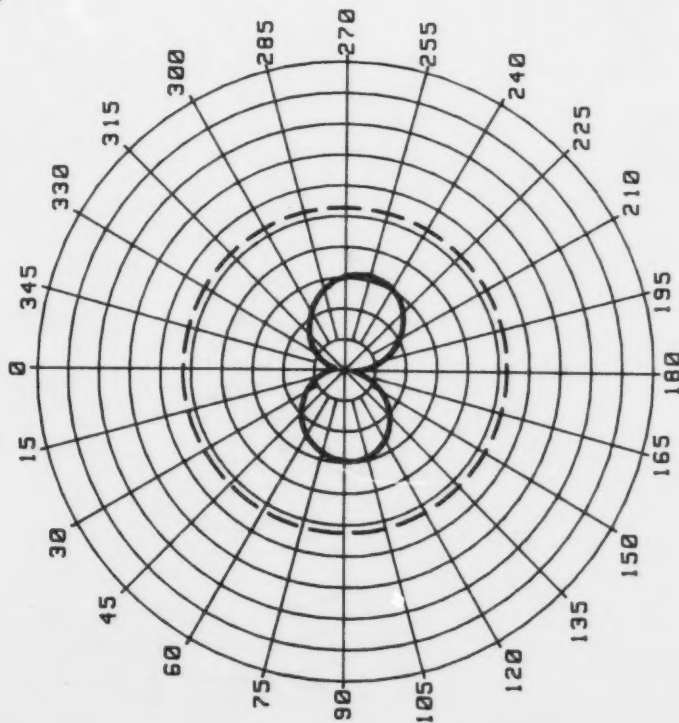
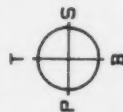
E-PHI

THE FULL-SCALE VALUE IS 1.86 [ISOTROPIC]
---- ISOTROPIC LEVEL

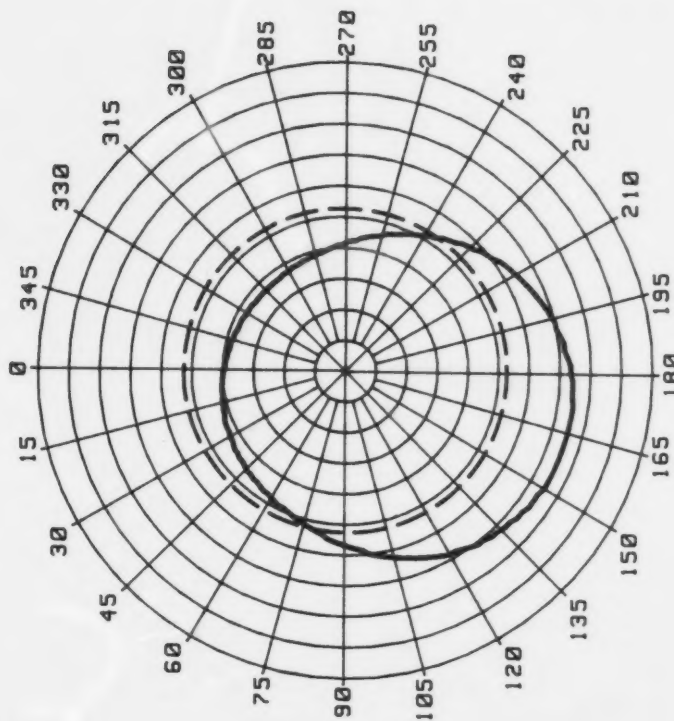
NEC ELECTROMAGNETIC ENGINEERING
21 JAN 1986 12:43:13

COMPILED FROM VOLUME C46 FILE SPECIFIC 01
THE ISOTROPIC LEVEL WAS -7.38 dB

CH-135 MODEL HELICOPTER 312.00 MHz
CH-135 HELICOPTER 13.00 MHz
ROLL PLANE PATTERNS



E-THETA

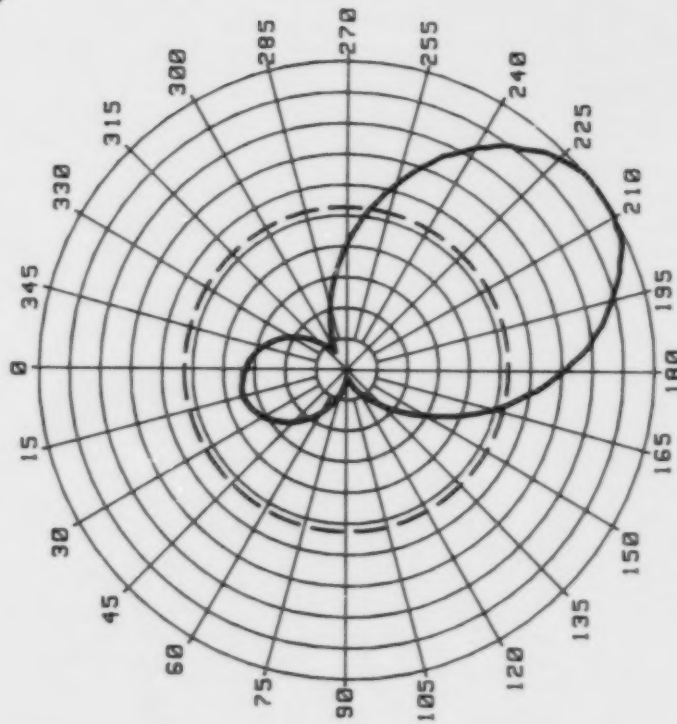


E-PHI

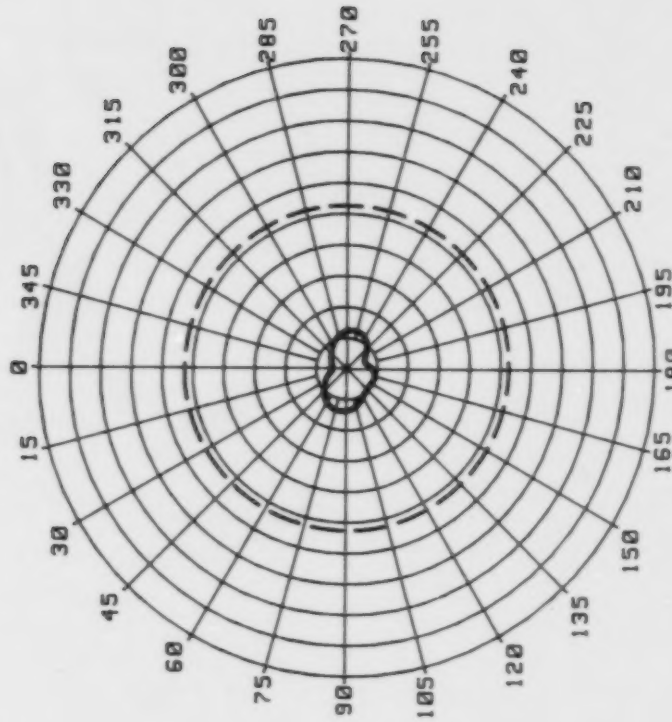
THE FULL-SCALE VALUE IS 1.90 [ISOTROPIC]

--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 312.00 MHz
CH-135 HELICOPTER 13.00 MHz
PITCH PLANE PATTERNS



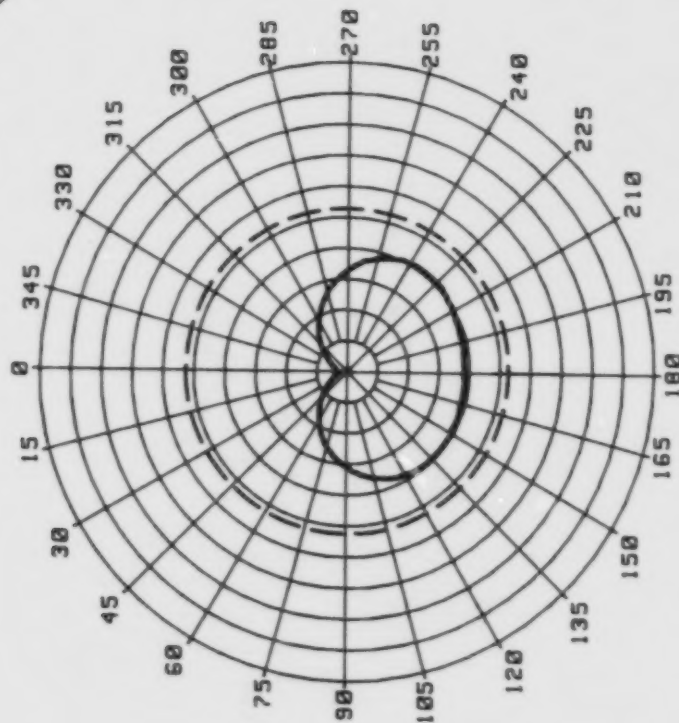
E-THETA



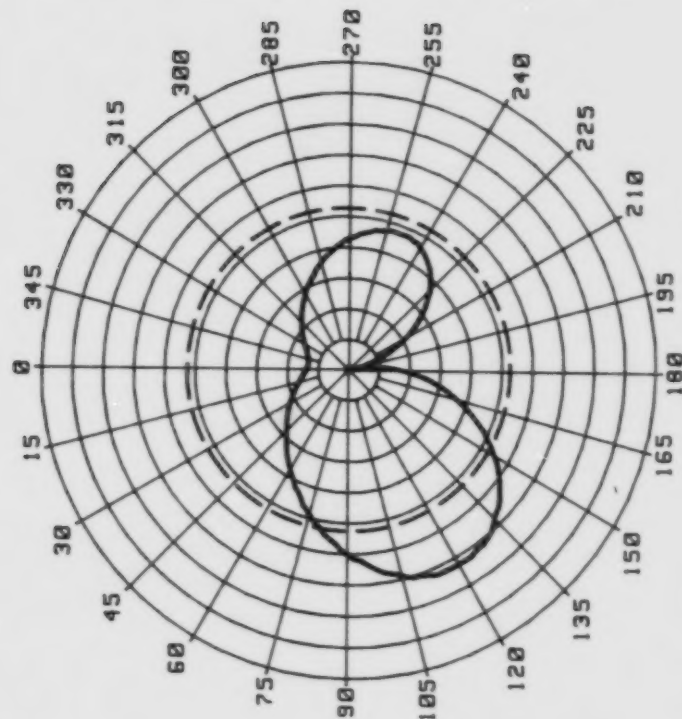
E-PHI

THE FULL-SCALE VALUE IS 1.90 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 312.00 MHz
CH-135 HELICOPTER 13.00 MHz
YAW PLANE PATTERNS



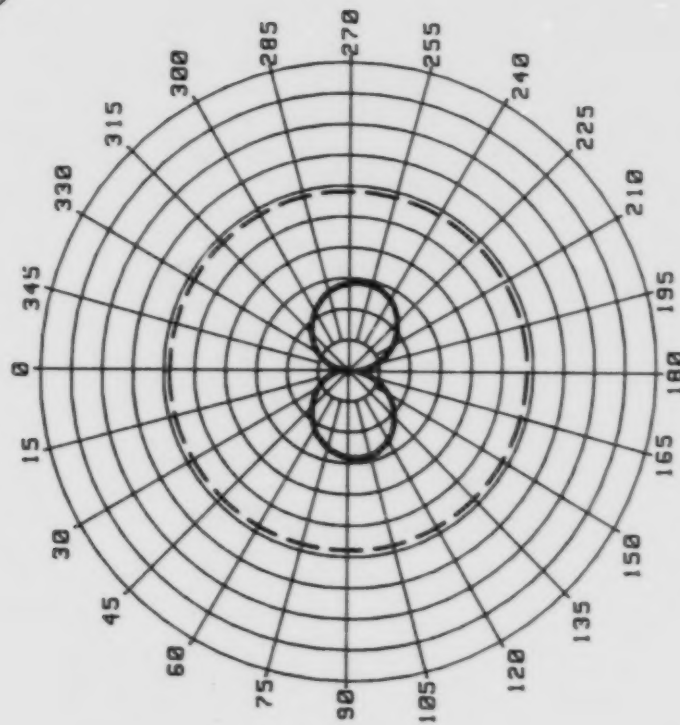
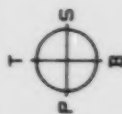
E-THETA



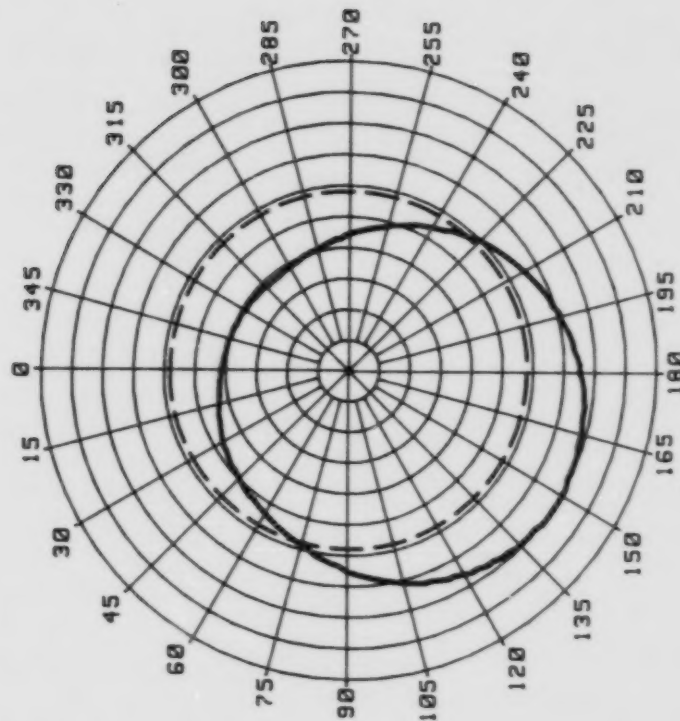
E-PHI

THE FULL-SCALE VALUE IS 1.90 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 336.00 MHz
CH-135 HELICOPTER 14.00 MHz
ROLL PLANE PATTERNS



E-THETA



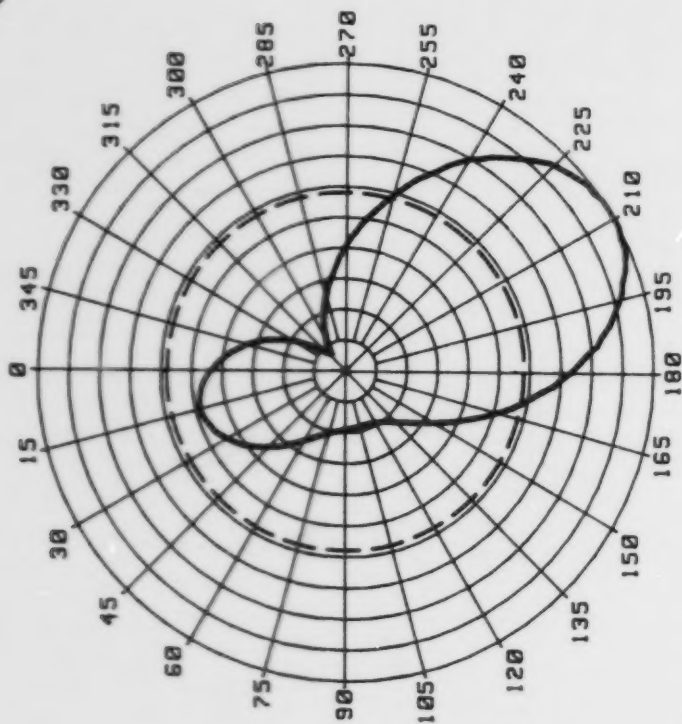
E-PHI

THE FULL-SCALE VALUE IS 1.73 [ISOTROPIC]
--- ISOTROPIC LEVEL

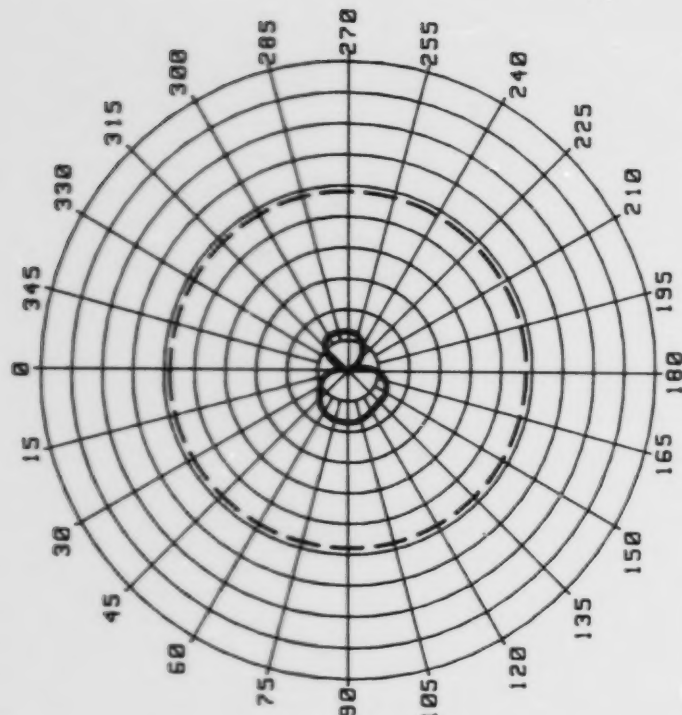
NBC ELECTROMAGNETIC ENGINEERING
 21 JUN 1966 13:32:56

COMPILED FROM VOLUME OAS FILE SPECIFICATION 21
 THE ISOTROPIC LEVEL WAS -7.34 dB

CH-135 MODEL HELICOPTER 336.00 MHz
 CH-135 HELICOPTER 14.00 MHz
 PITCH PLANE PATTERNS



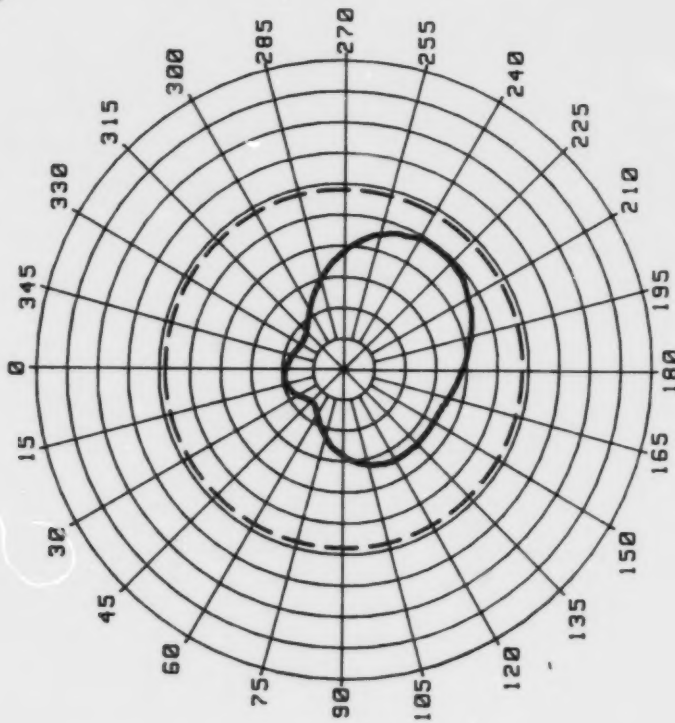
E-THETA



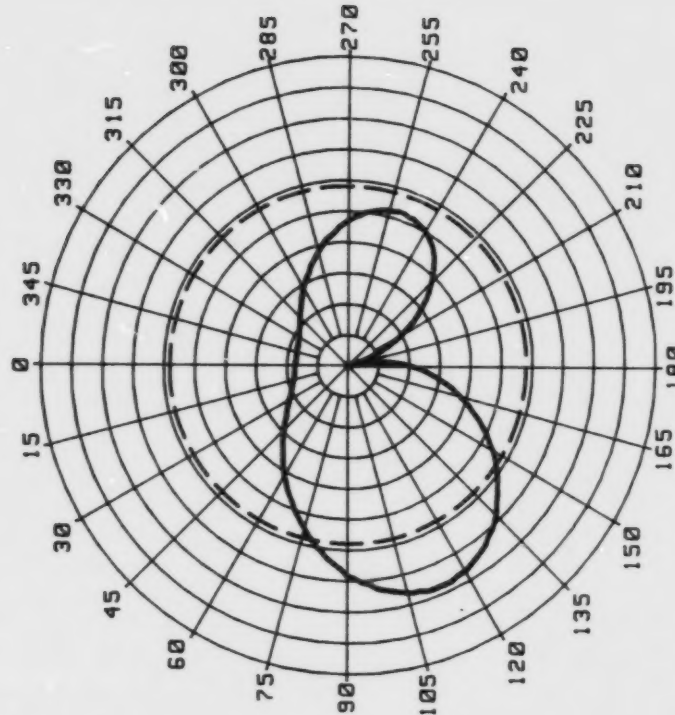
E-PHI

THE FULL-SCALE VALUE IS 1.73 [ISOTROPIC]
 --- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 336.00 MHz
 CH-135 HELICOPTER 14.00 MHz
 YAW PLANE PATTERNS



E-THETA



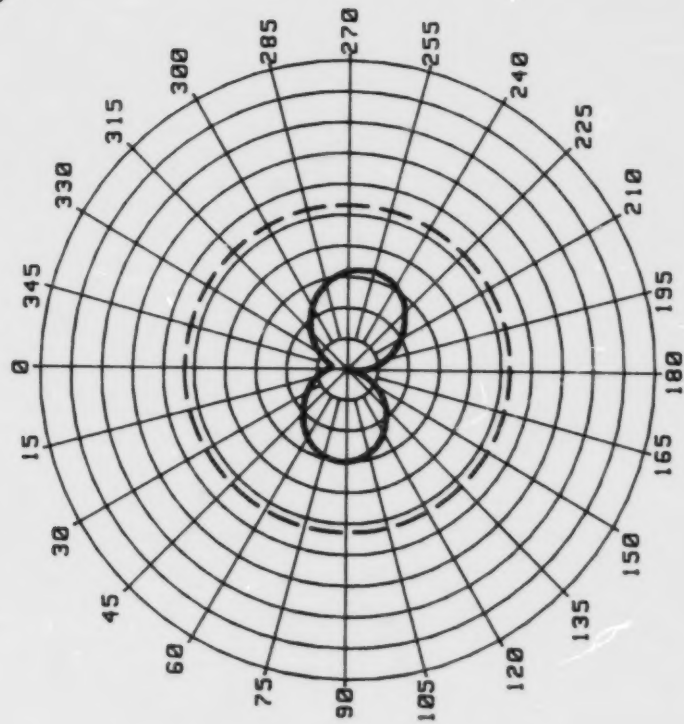
E-PHI

THE FULL-SCALE VALUE IS 1.73 [ISOTROPIC]
 --- ISOTROPIC LEVEL

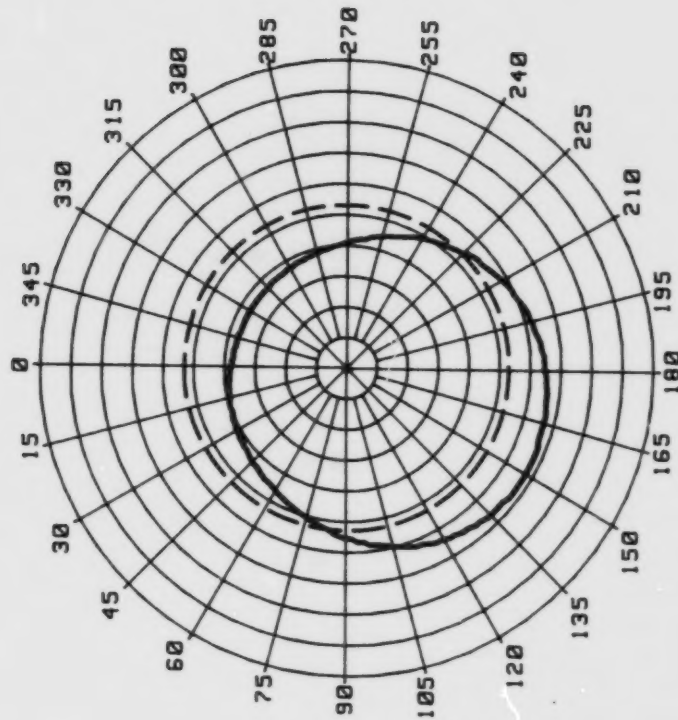
NRIC ELECTROMAGNETIC ENGINEERING
21 JUN 1986 13:47:02

COMPILED FROM VOLUME ONE FILE SPECIFICATION U
THE ISOTROPIC LEVEL HAS -8.32 dB

CH-135 MODEL HELICOPTER 360.00 MHz
CH-135 HELICOPTER 15.00 MHz
ROLL PLANE PATTERNS



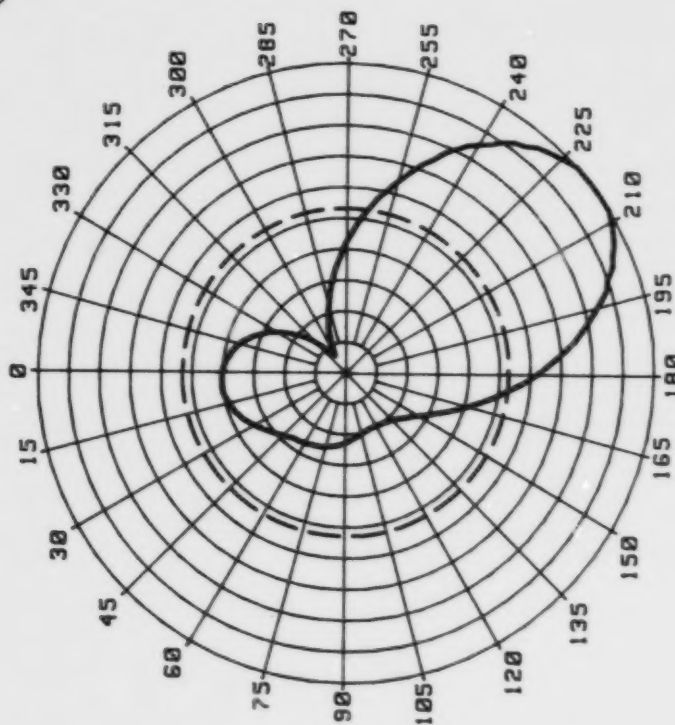
E-THETA



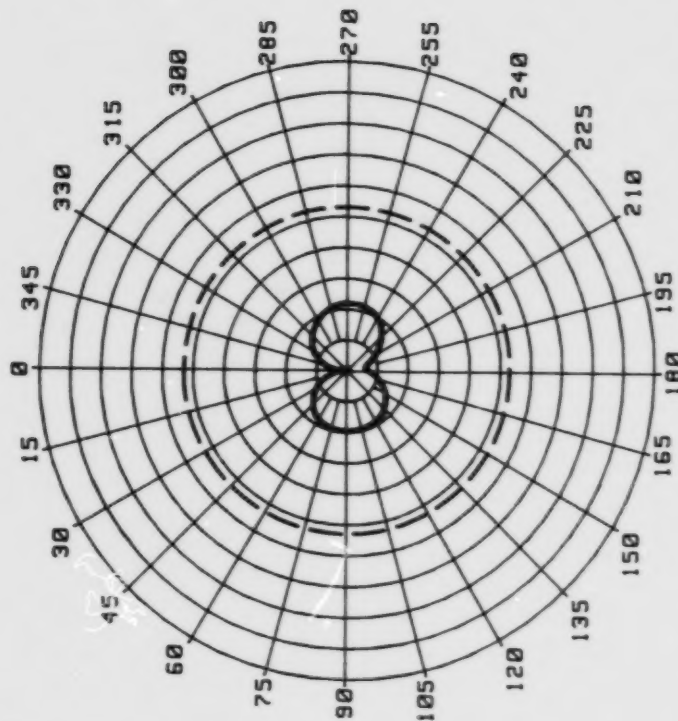
E-PHI

THE FULL-SCALE VALUE IS 1.89 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 360.00 MHz
CH-135 HELICOPTER 15.00 MHz
PITCH PLANE PATTERNS



E-THETA



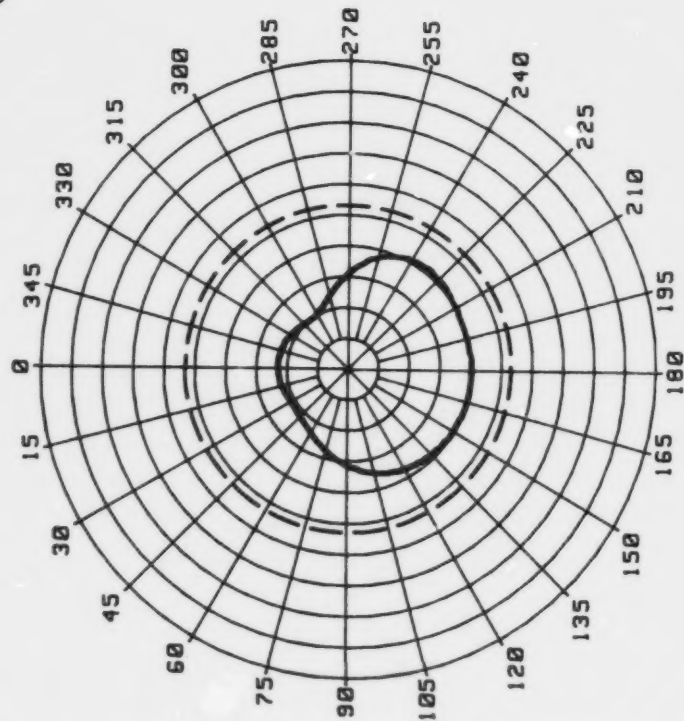
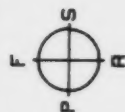
E-PHI

THE FULL-SCALE VALUE IS 1.89 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

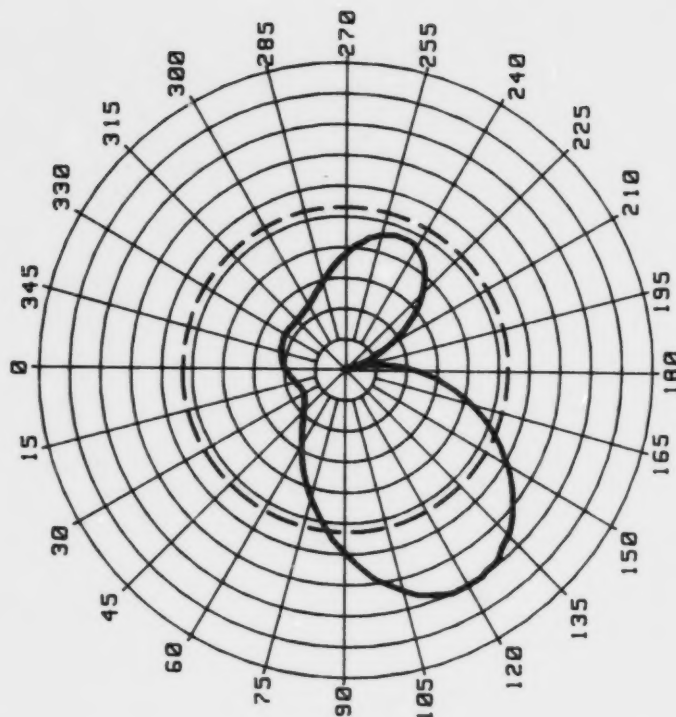
ARC ELECTROMAGNETIC ENGINEERING
21 JAN 1966 19:39:30

COMPILED FROM VOLUME ONE FILE SPECIFICATION U
THE ISOTROPIC LEVEL WAS -1.32 dB

CH-135 MODEL HELICOPTER 360.00 MHz
CH-135 HELICOPTER 15.00 MHz
YAW PLANE PATTERNS



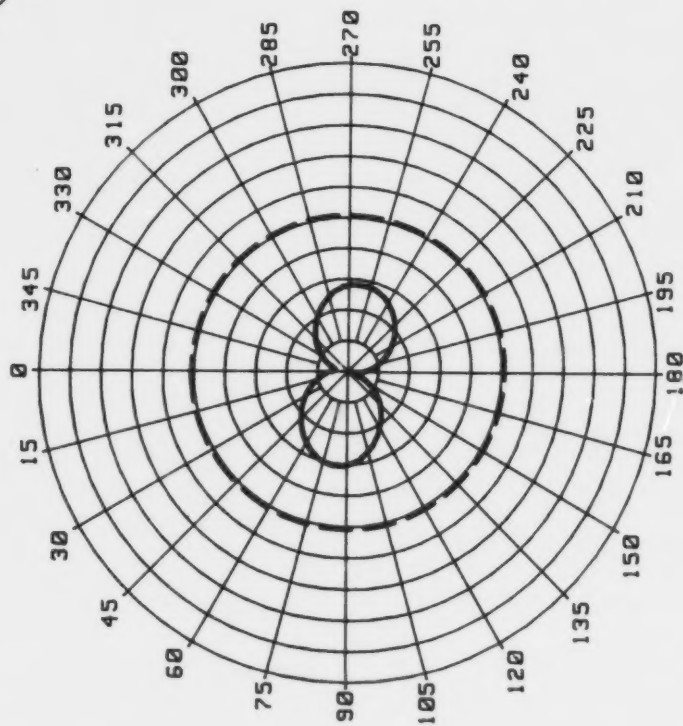
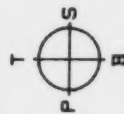
E-THETA



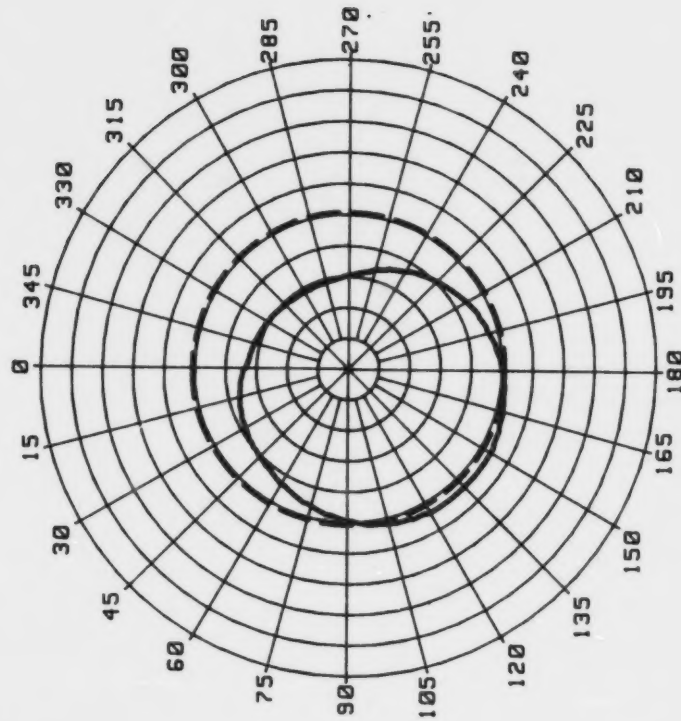
E-PHI

THE FULL-SCALE VALUE IS 1.89 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 384.00 MHz
CH-135 HELICOPTER 16.00 MHz
ROLL PLANE PATTERNS



E-THETA



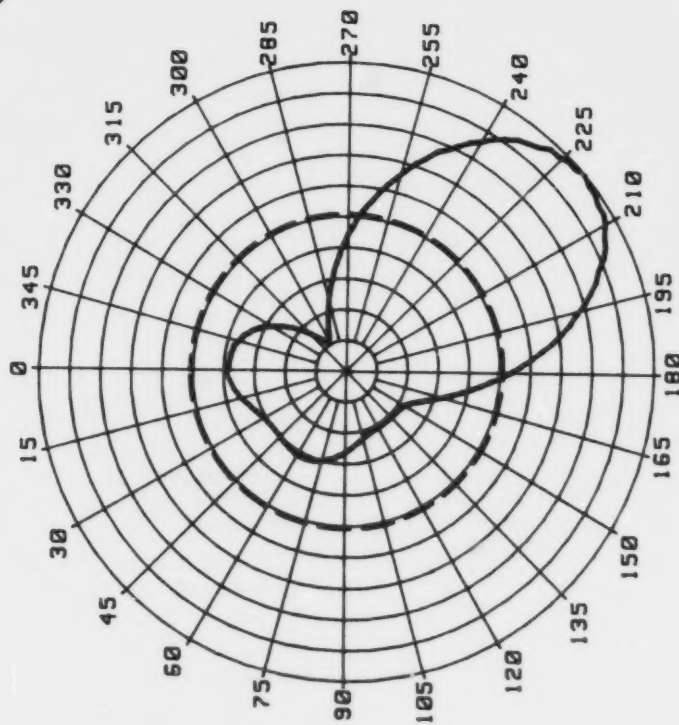
E-PHI

THE FULL-SCALE VALUE IS 1.97 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

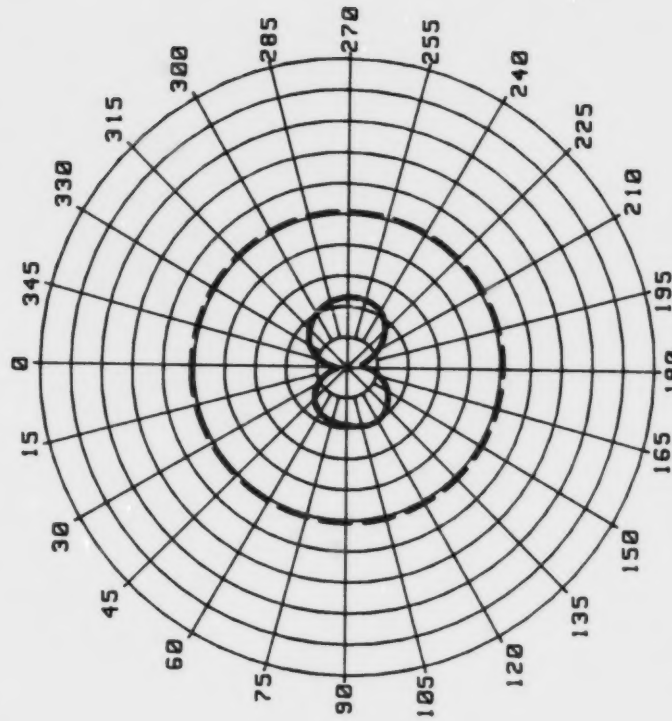
NRC ELECTROMAGNETIC ENGINEERING
4 FEB 1986 12:48:03

COMPILED FROM VOLUME ONE FILE SPECIFIER H
THE ISOTROPIC LEVEL WAS -7.87 dB

CH-135 MODEL HELICOPTER 384.00 MHz
CH-135 HELICOPTER 16.00 MHz
PITCH PLANE PATTERNS



E-THETA

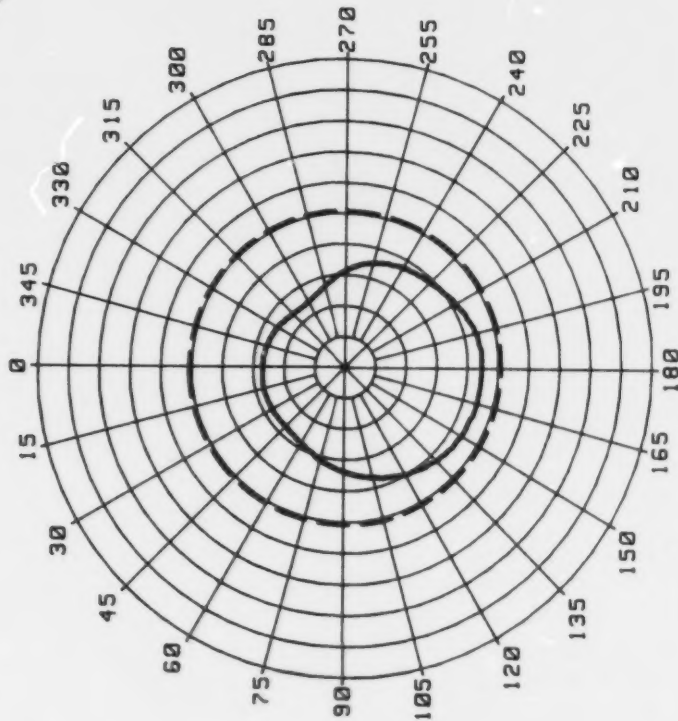


E-PHI

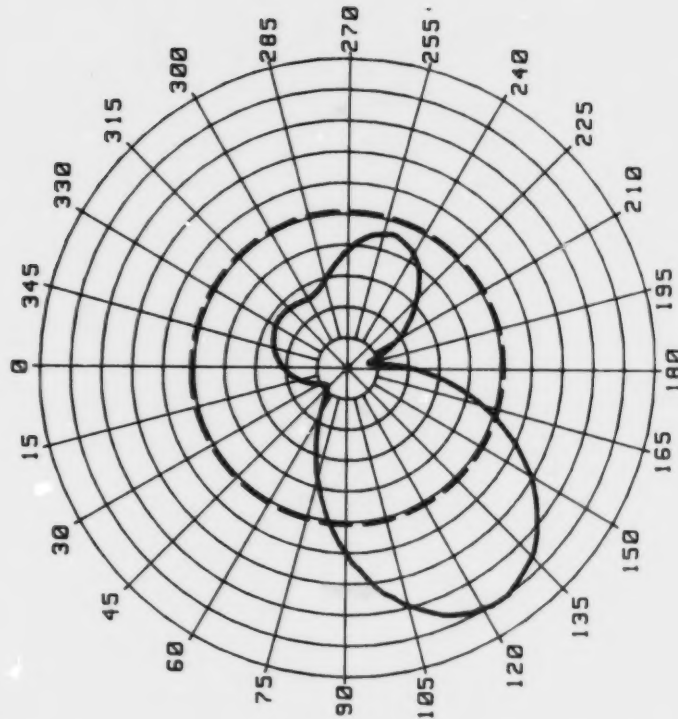
THE FULL-SCALE VALUE IS 1.97 [ISOTROPIC]

--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 384.00 MHz
CH-135 HELICOPTER 16.00 MHz
YAW PLANE PATTERNS



E-THETA



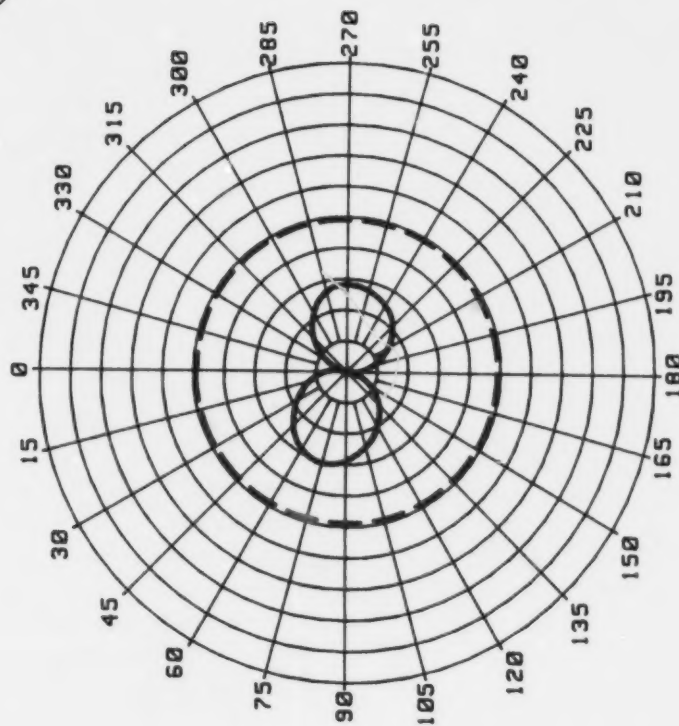
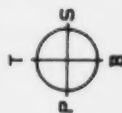
E-PHI

THE FULL-SCALE VALUE IS 1.97 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

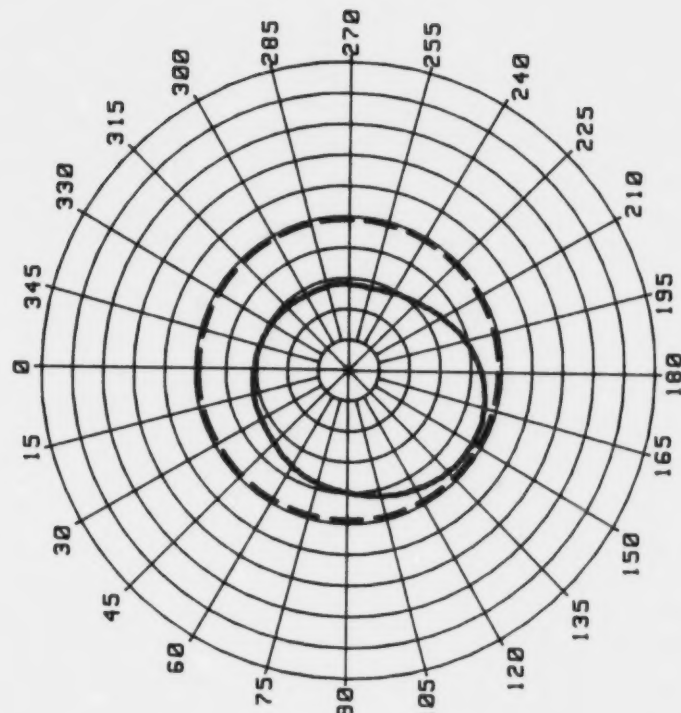
NRC ELECTROMAGNETIC ENGINEERING
21 J/N 1986 14:27:28

COMPILED FROM VOLUME CH88 FILE SPECIFICATION Y2
THE ISOTROPIC LEVEL WAS -8.34 dB

CH-135 MODEL HELICOPTER 408.00 MHz
CH-135 HELICOPTER 17.00 MHz
ROLL PLANE PATTERNS



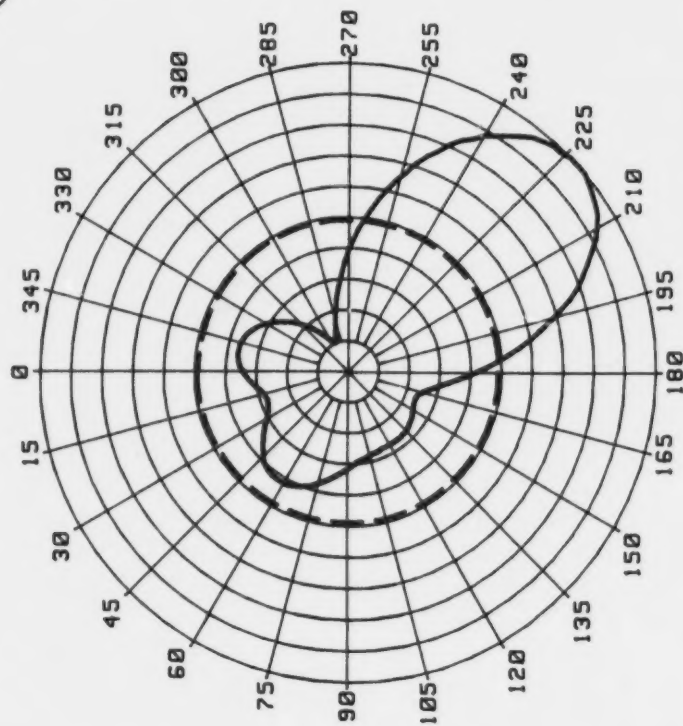
E-THETA



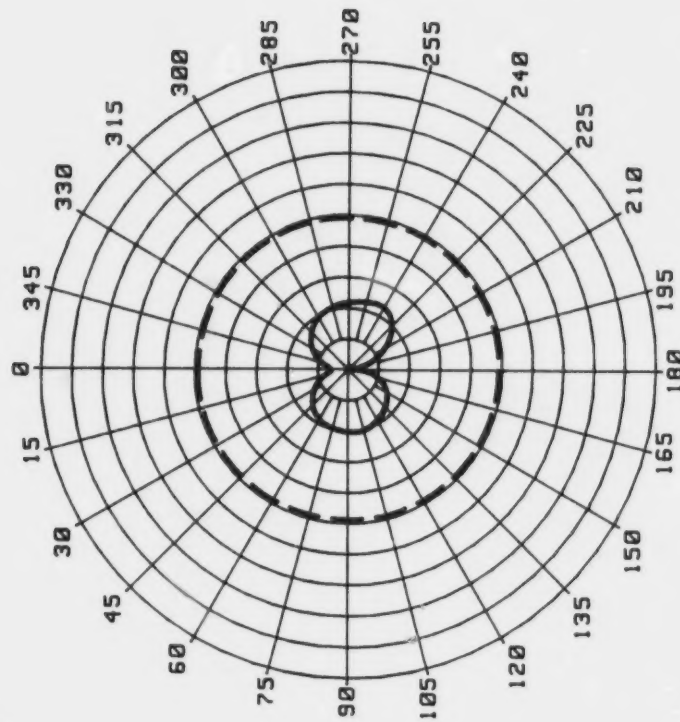
E-PHI

THE FULL-SCALE VALUE IS 2.05 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 408.00 MHz
CH-135 HELICOPTER 17.00 MHz
PITCH PLANE PATTERNS



E-THETA



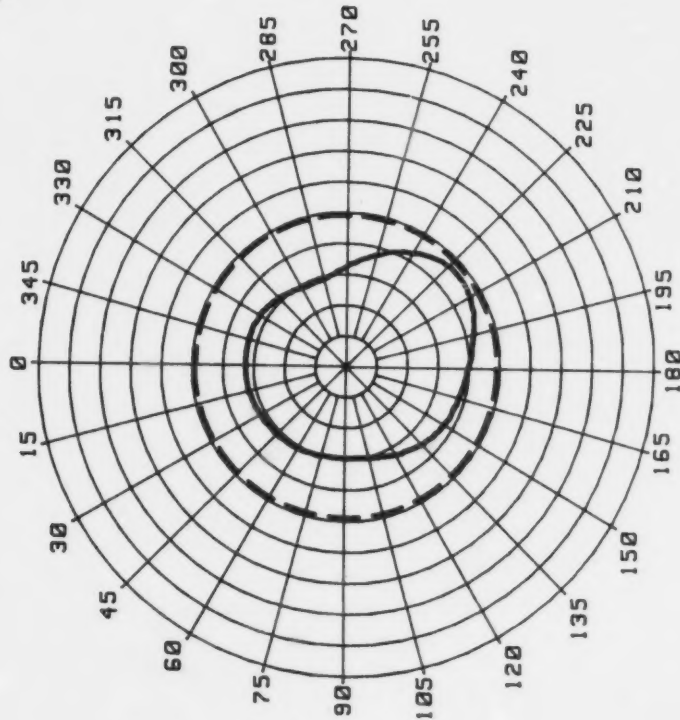
E-PHI

THE FULL-SCALE VALUE IS 2.05 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

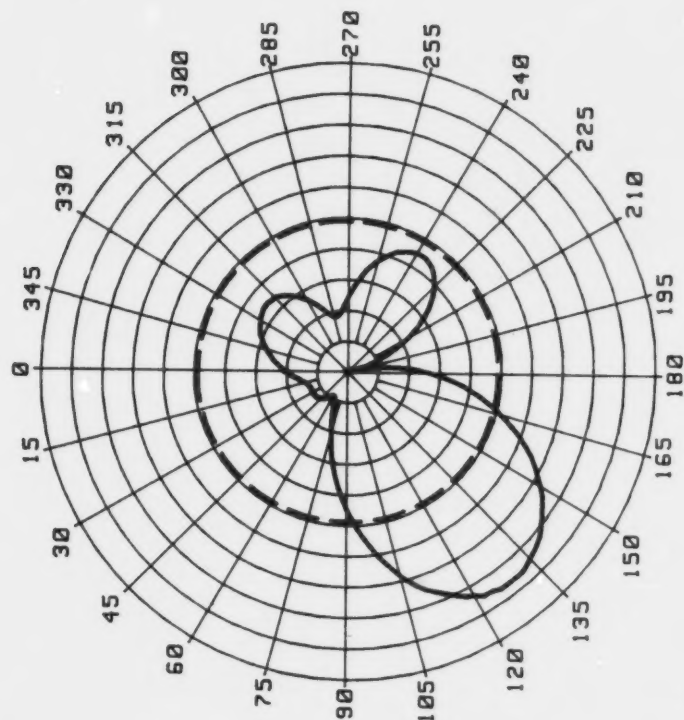
NRC ELECTROMAGNETIC ENGINEERING
21 JAN 1986 141811Z4

COMPILED FROM VOLUME CH88 FILE SPECIFIER Y2
THE ISOTROPIC LEVEL WAS -8.94 dB

CH-135 MODEL HELICOPTER 408.00 MHz
CH-135 HELICOPTER 17.00 MHz
YAW PLANE PATTERNS



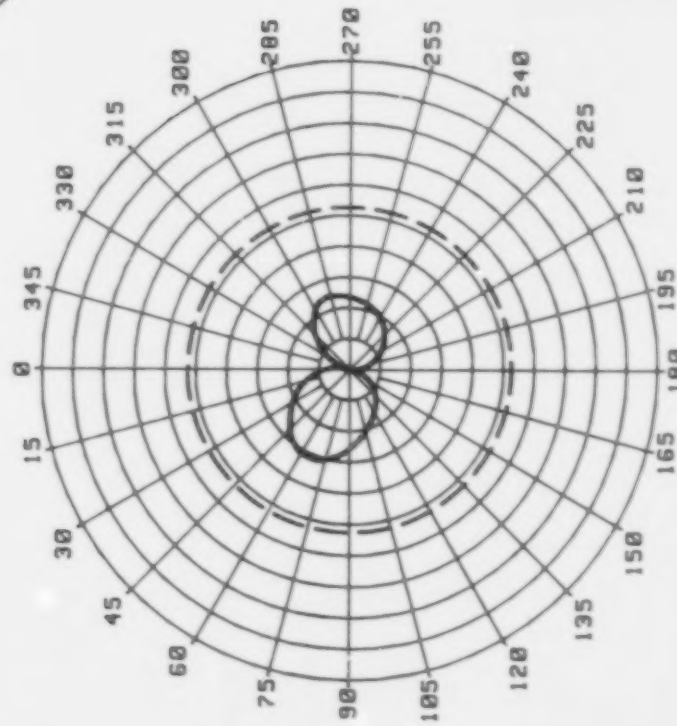
E-THETA



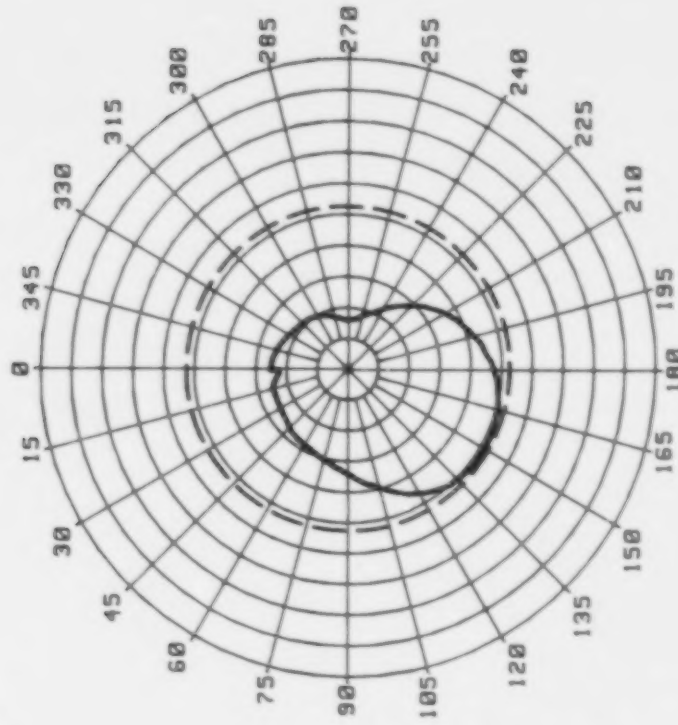
E-PHI

THE FULL-SCALE VALUE IS 2.05 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 432.00 MHz
CH-135 HELICOPTER 18.00 MHz
ROLL PLANE PATTERNS



E-THETA



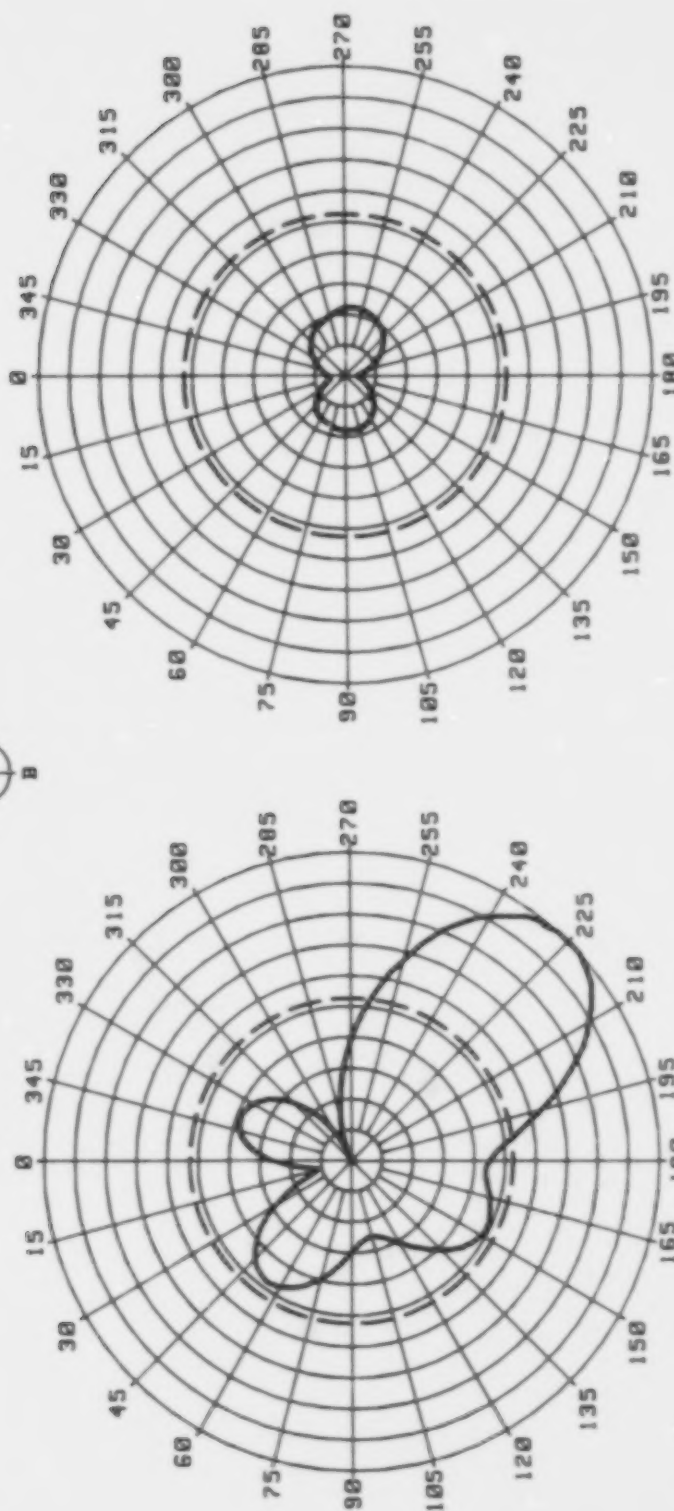
E-PHI

THE FULL-SCALE VALUE IS 1.90 [ISOTROPIC]
--- ISOTROPIC LEVEL

NSC ELECTROMAGNETIC ENGINEERING
4 FEB 1966 14:15:48

COMPILED FROM VOLUME ONE FILE SPECIFIER *
THE ISOTROPIC LEVEL WAS -6.79 dB

CH-135 MODEL HELICOPTER 432.00 MHz CH-135 HELICOPTER 18.00 MHz PITCH PLANE PATTERNS

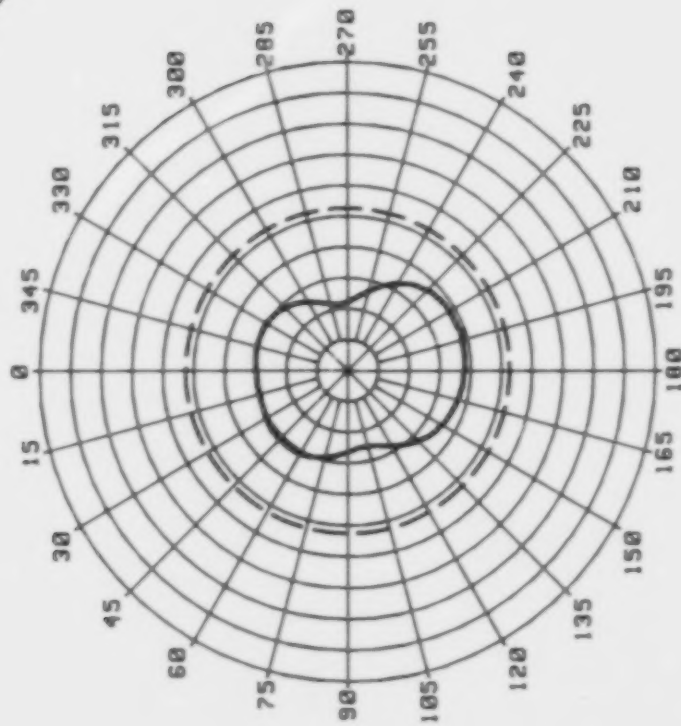


E-THETA

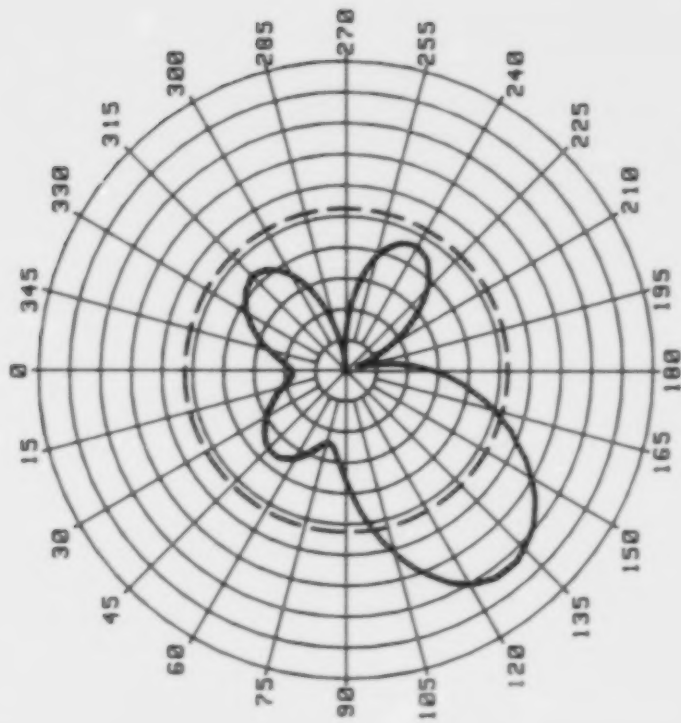
E-PHI

THE FULL-SCALE VALUE IS 1.90 [ISOTROPIC]
--- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 432.00 MHz
 CH-135 HELICOPTER 18.00 MHz
 YAW PLANE PATTERNS



E-THETA



E-PHI

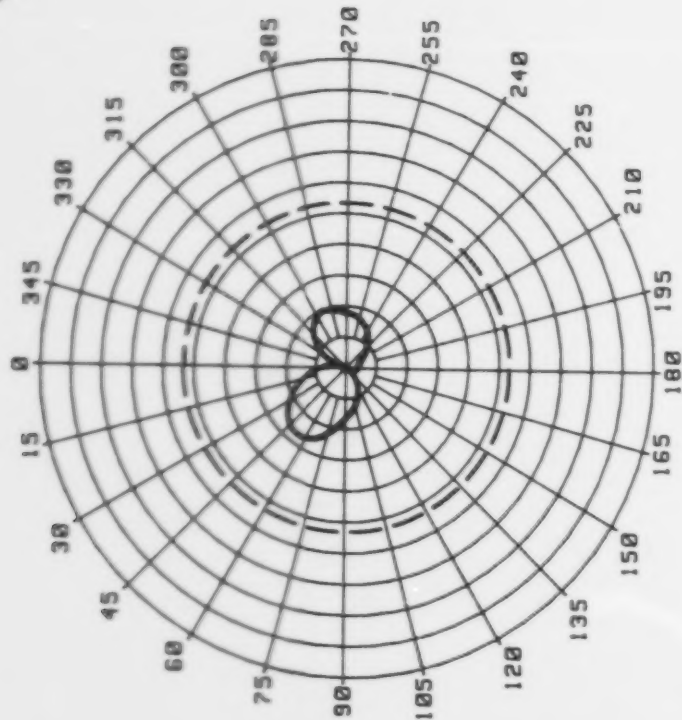
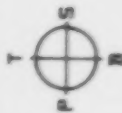
THE FULL-SCALE VALUE IS 1.90 [ISOTROPIC]

--- ISOTROPIC LEVEL

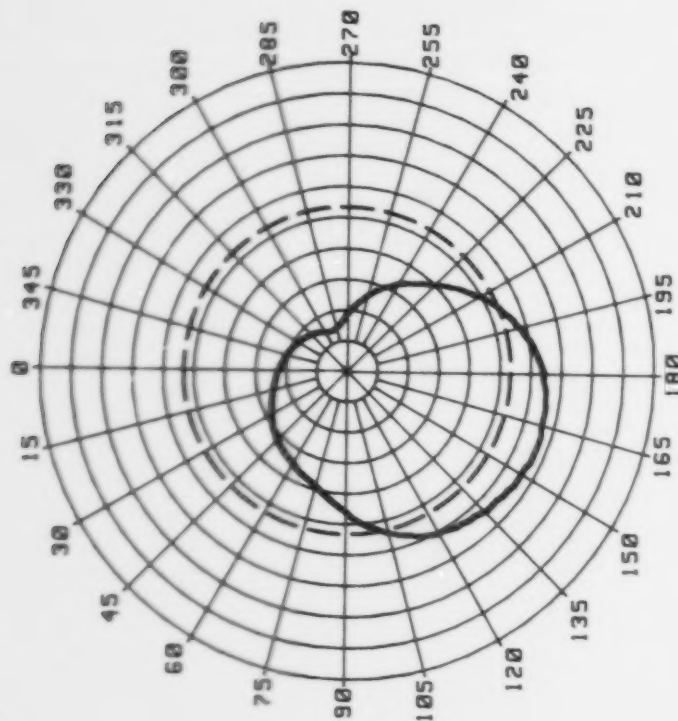
ARC ELECTRONNETIC ENGINEERING
 81 JUN 1986 15:18:01

COMPILED FROM VOLANT GND FILE SPECIFIER :
 THE ISOTROPIC LEVEL WAS -8.87 dB

CH-135 MODEL HELICOPTER 456.00 MHz
 CH-135 HELICOPTER 19.00 MHz
 ROLL PLANE PATTERNS



E-THETA

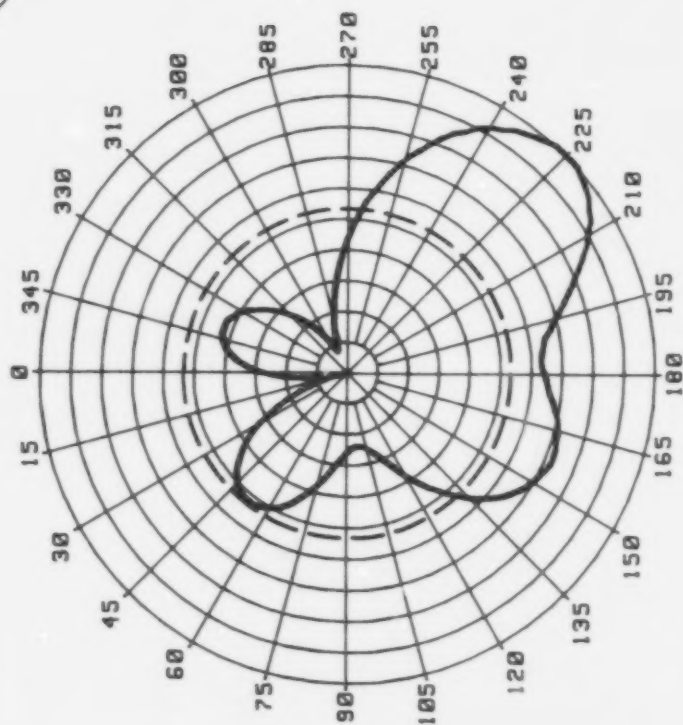


E-PHI

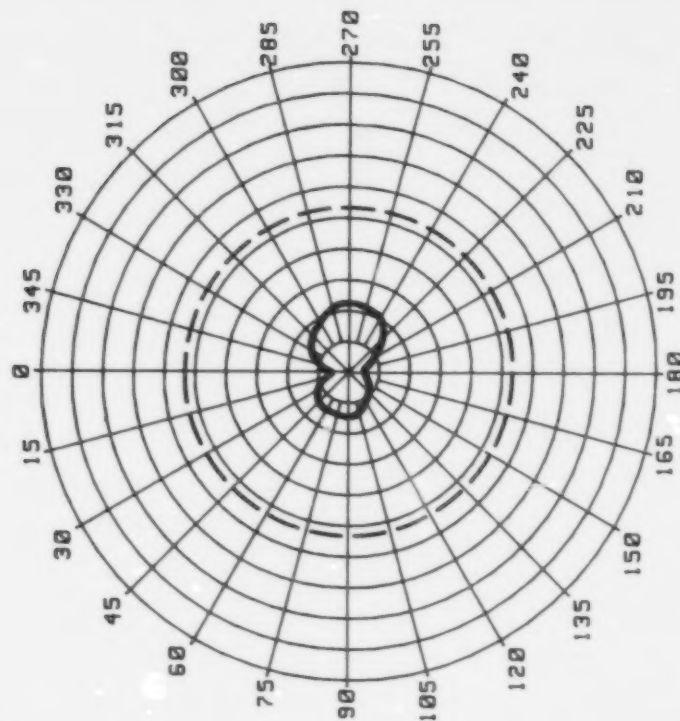
THE FULL-SCALE VALUE IS 1.00 [ISOTROPIC]

--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 456.00 MHz
 CH-135 HELICOPTER 19.00 MHz
 PITCH PLANE PATTERNS



E-THETA



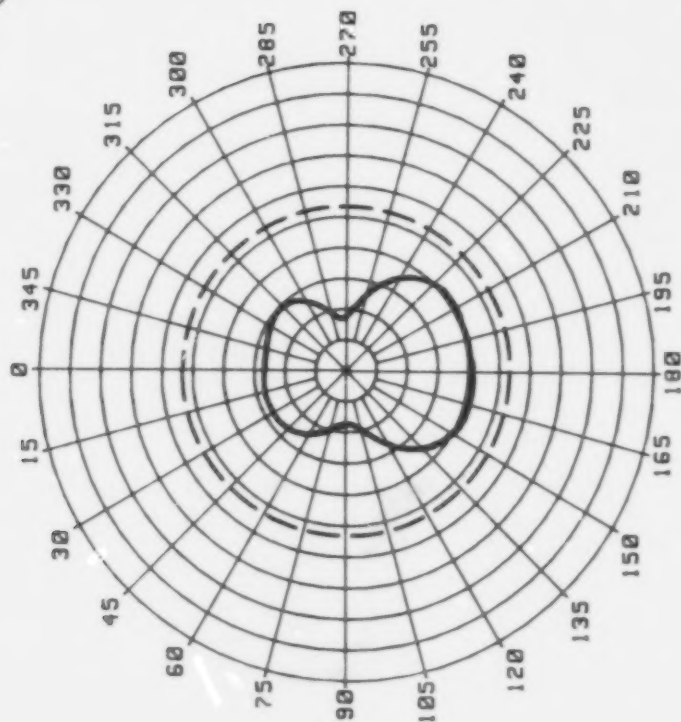
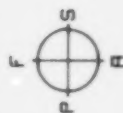
E-PHI

THE FULL-SCALE VALUE IS 1.00 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

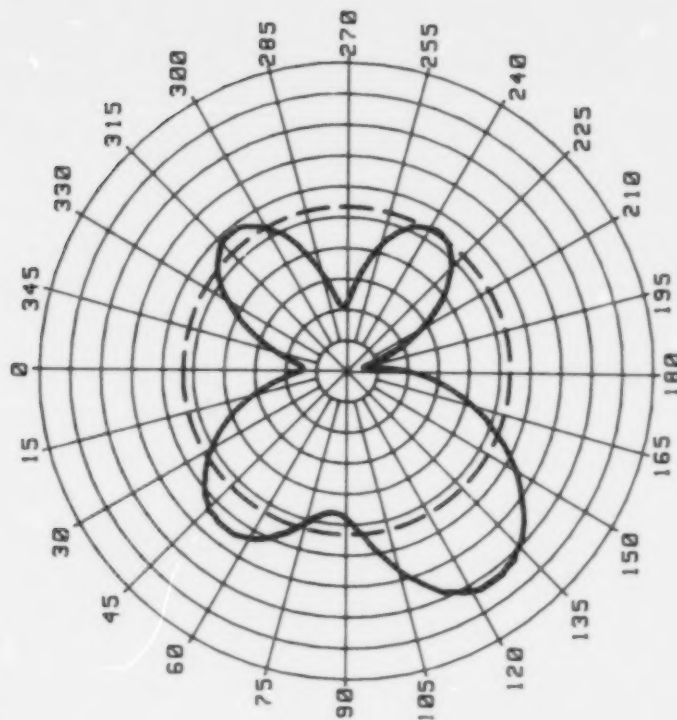
HMC ELECTROMAGNETIC ENGINEERING
 21 JAN 1986 151841Z

COMPILED FROM VOLUME CHB FILE SPECIFIER.
 THE ISOTROPIC LEVEL WAS -6.37 dB

CH-135 MODEL HELICOPTER 456.00 MHz
 CH-135 HELICOPTER 19.00 MHz
 YAW PLANE PATTERNS



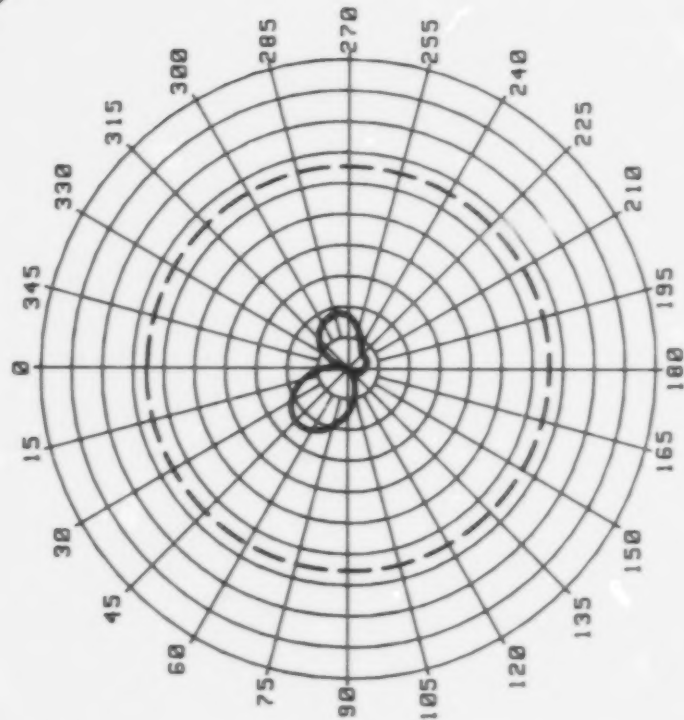
E-THETA



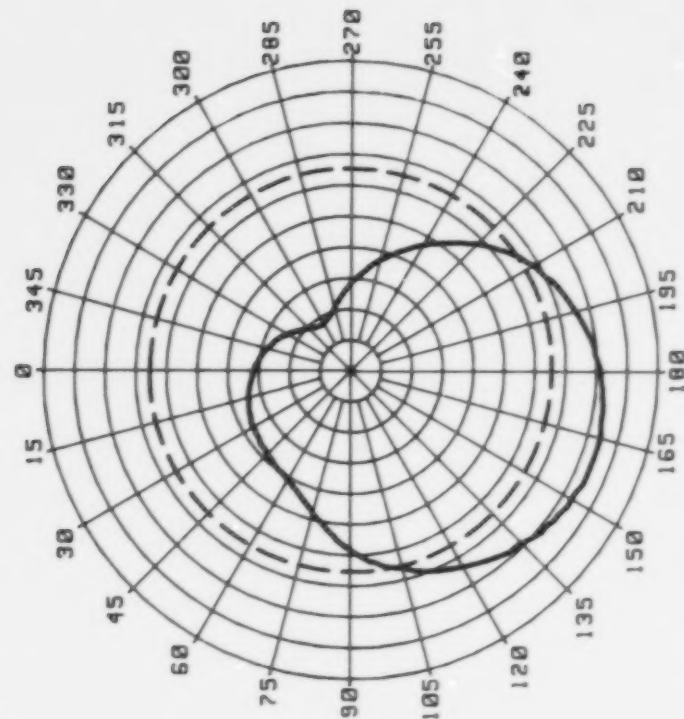
E-PHI

THE FULL-SCALE VALUE IS 1.88 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 480.00 MHz
CH-135 HELICOPTER 20.00 MHz
ROLL PLANE PATTERNS



E-THETA



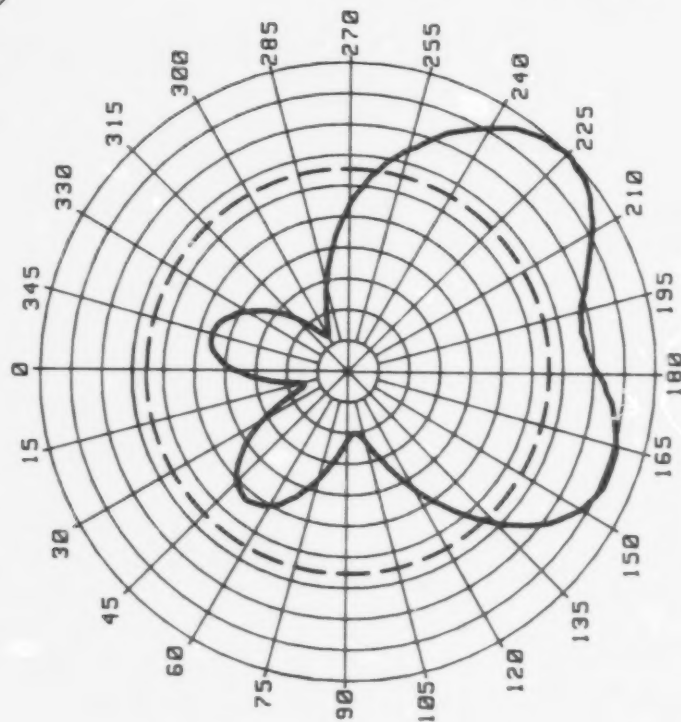
E-PHI

THE FULL-SCALE VALUE IS 1.53 [ISOTROPIC]
--- ISOTROPIC LEVEL

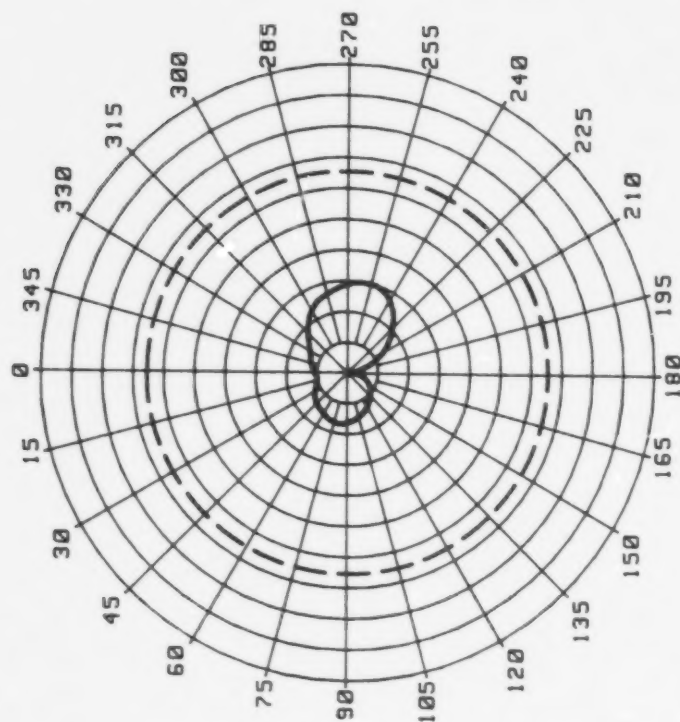
HRC ELECTROMAGNETIC ENGINEERING
 21 JAN 1986 15:36:58

COMPILED FROM VOLUME CH11 FILE SPECIFIER a
 THE ISOTROPIC LEVEL WAS -8.99 dB

CH-135 MODEL HELICOPTER 480.00 MHz
 CH-135 HELICOPTER 20.00 MHz
 PITCH PLANE PATTERNS



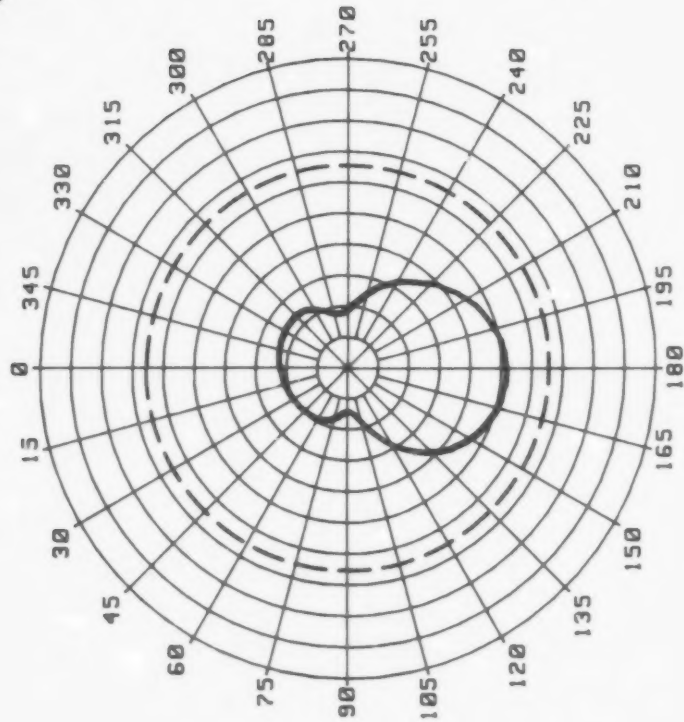
E-THETA



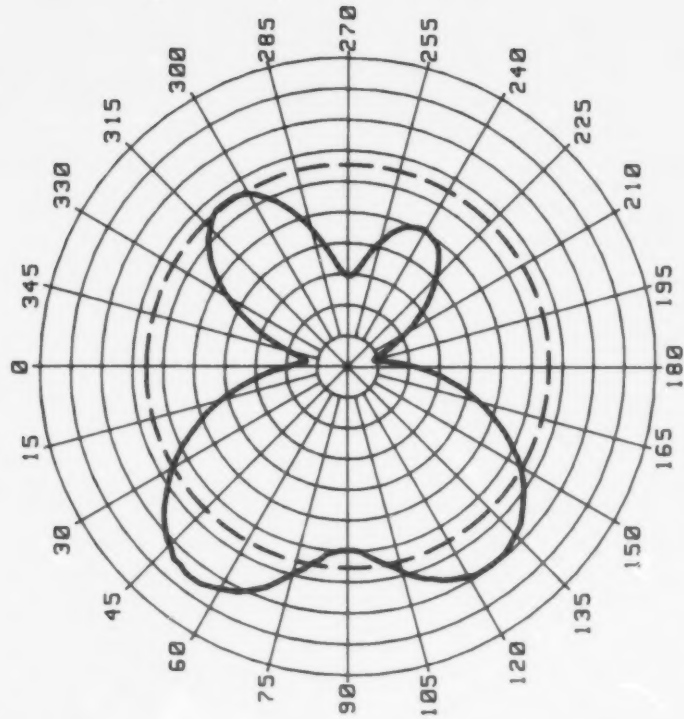
E-PHI

THE FULL-SCALE VALUE IS 1.53 [ISOTROPIC]
 --- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 480.00 MHz
CH-135 HELICOPTER 20.00 MHz
YAW PLANE PATTERNS



E-THETA



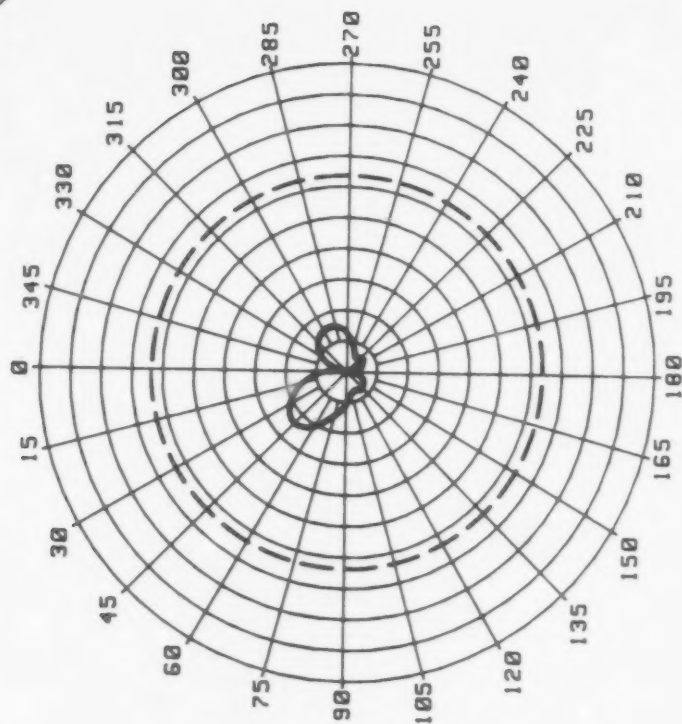
E-PHI

THE FULL-SCALE VALUE IS 1.53 [ISOTROPIC]
--- ISOTROPIC LEVEL

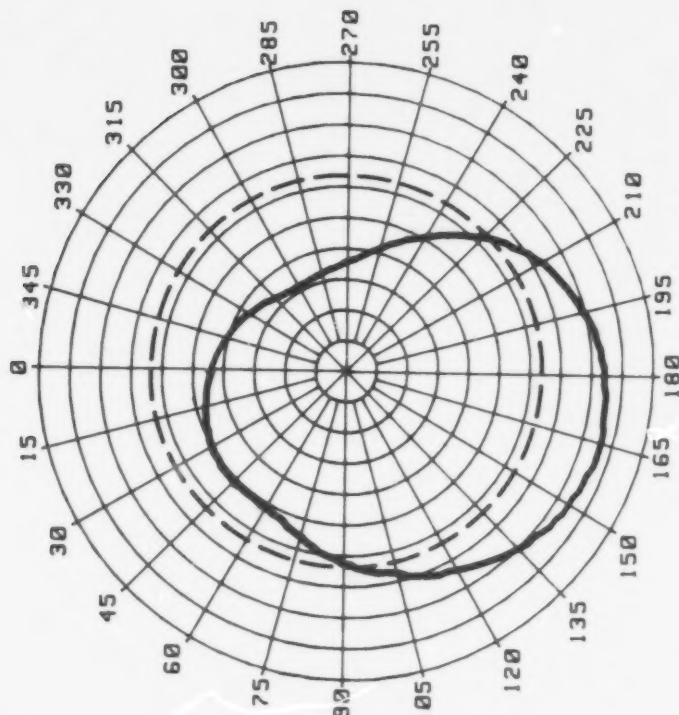
NRC ELECTROMAGNETIC ENGINEERING
21 JAN 1986 16:02:26

COMPILED FROM VOLUME ONE FILE SPECIFIER 0
THE ISOTROPIC LEVEL WAS -8.13 dB

CH-135 MODEL HELICOPTER 504.00 MHz
CH-135 HELICOPTER 21.00 MHz
ROLL PLANE PATTERNS



E-THETA

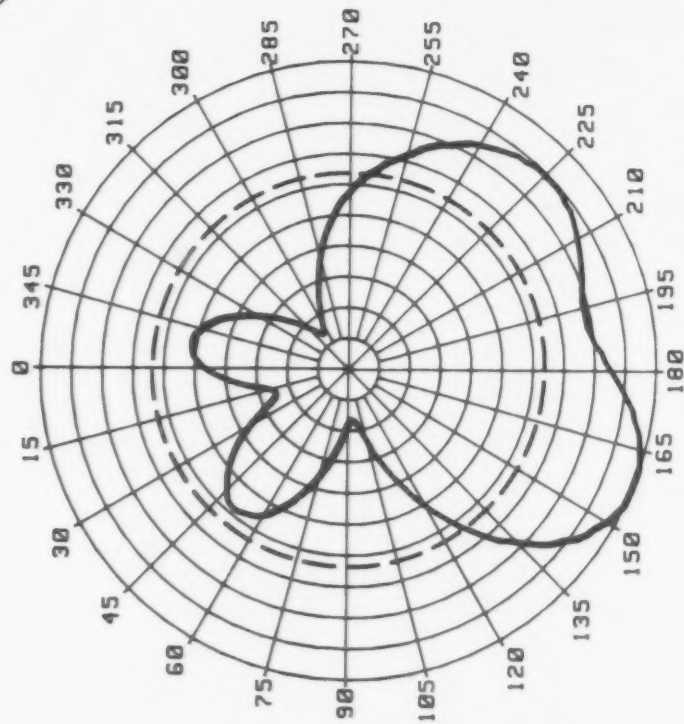


E-PHI

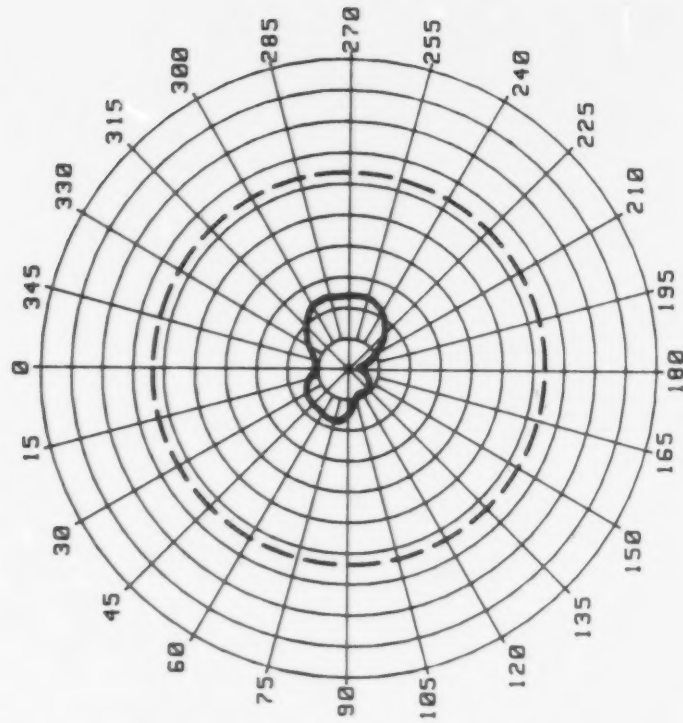
THE FULL-SCALE VALUE IS 1.57 [ISOTROPIC]

--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 504.00 MHz
CH-135 HELICOPTER 21.00 MHz
PITCH PLANE PATTERNS



E-THETA



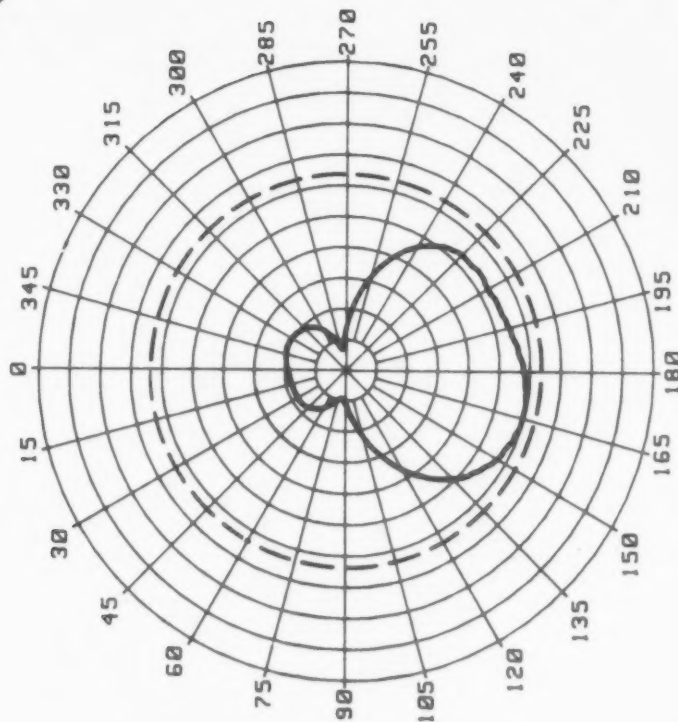
E-PHI

THE FULL-SCALE VALUE IS 1.57 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

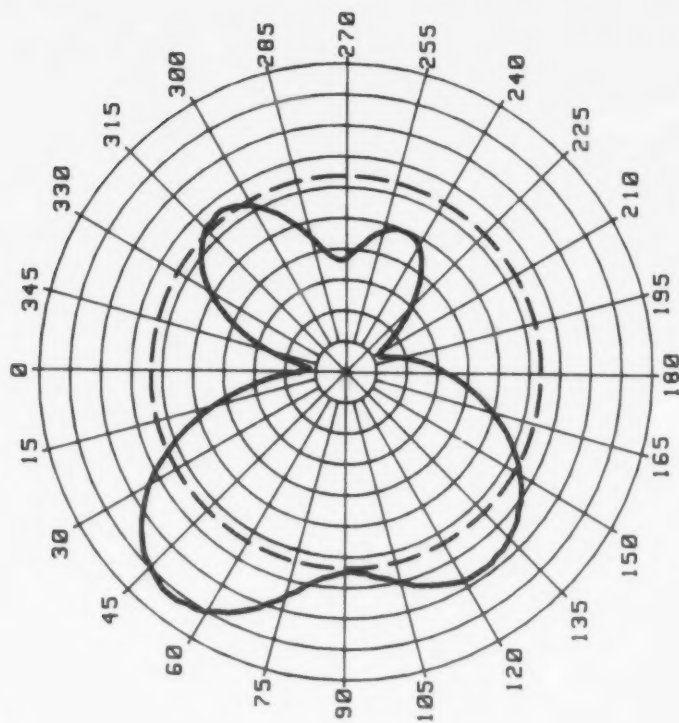
NRIC ELECTROMAGNETIC ENGINEERING
21 JAN 1986 15:56:28

COMPILED FROM VOLUME ONE FILE SPECIFICATION 8
THE ISOTROPIC LEVEL WAS -8.13 dB

CH-135 MODEL HELICOPTER 504.00 MHz
CH-135 HELICOPTER 21.00 MHz
YAW PLANE PATTERNS



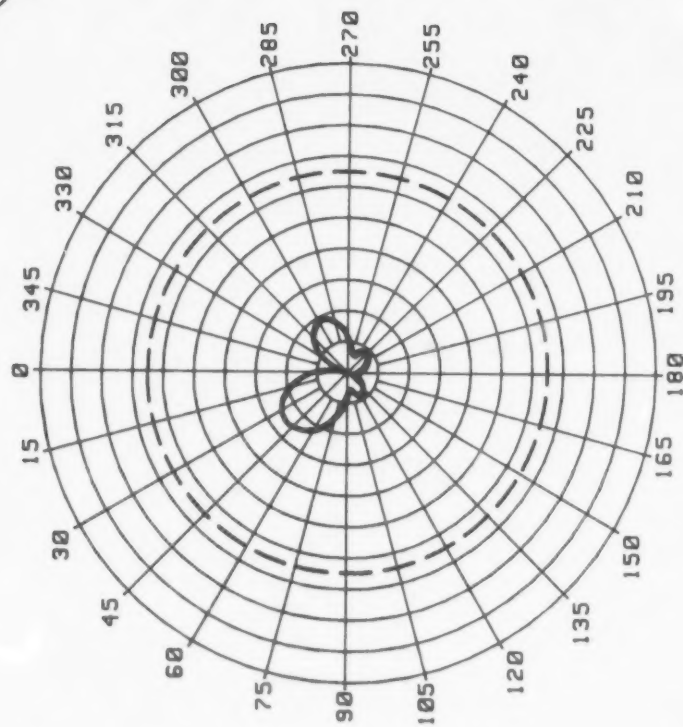
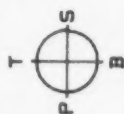
E-THETA



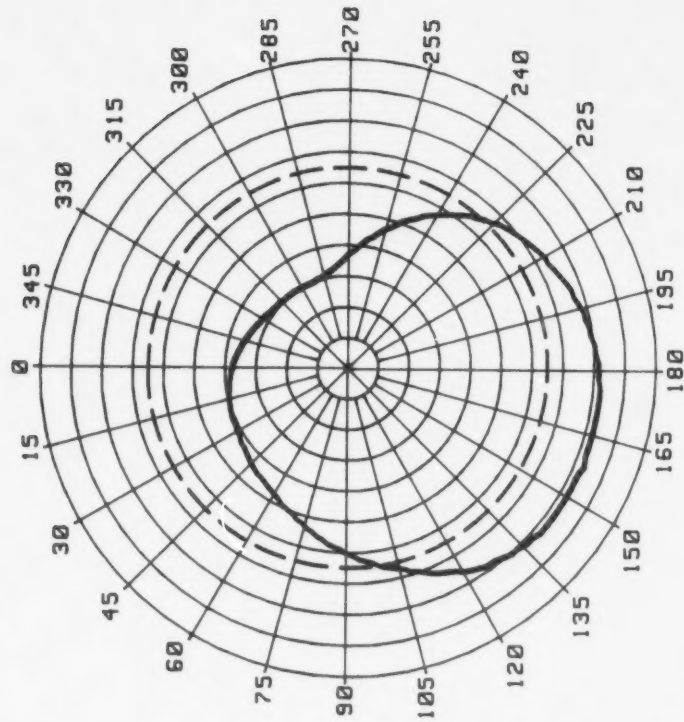
E-PHI

THE FULL-SCALE VALUE IS 1.57 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 528.00 MHz
 CH-135 HELICOPTER 22.00 MHz
 ROLL PLANE PATTERNS



E-THETA



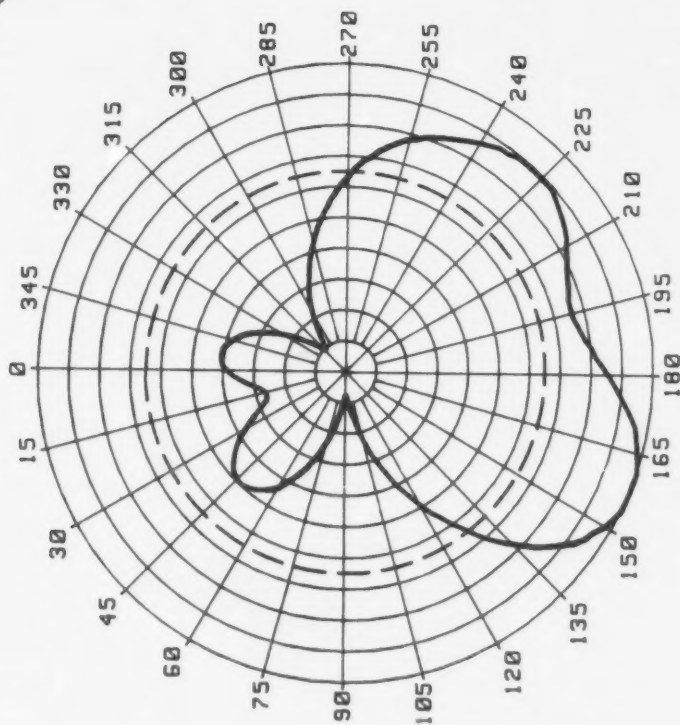
E-PHI

THE FULL-SCALE VALUE IS 1.54 [ISOTROPIC]
 --- ISOTROPIC LEVEL

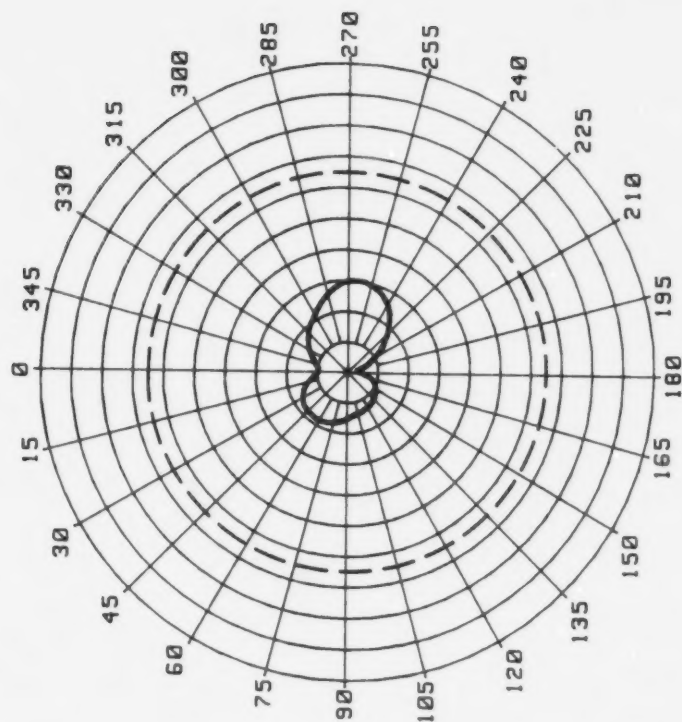
NRC ELECTROMAGNETIC ENGINEERING
21 JAN 1986 16:29:20

COMPILED FROM VOLUME CH135 FILE SPECIFIER 1
THE ISOTROPIC LEVEL WAS -8.66 dB

CH-135 MODEL HELICOPTER 528.00 MHz
CH-135 HELICOPTER 22.00 MHz
PITCH PLANE PATTERNS



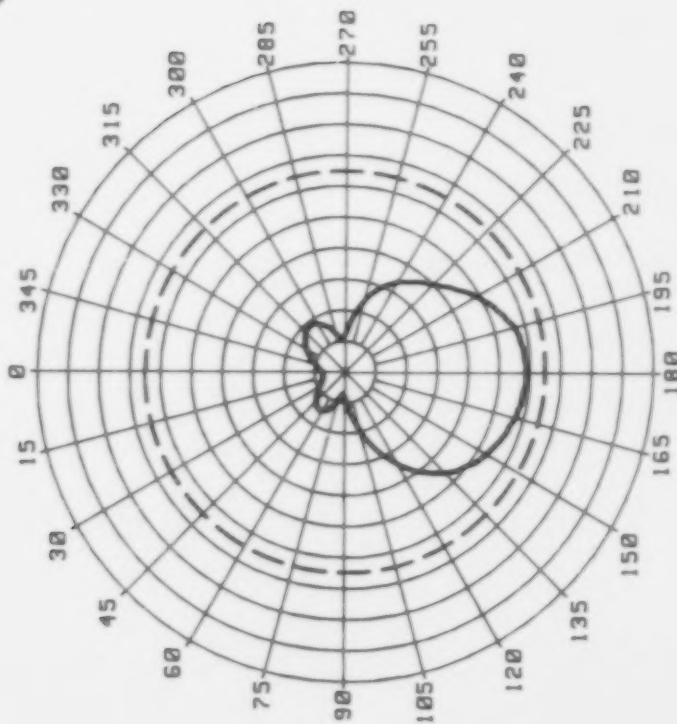
E-THETA



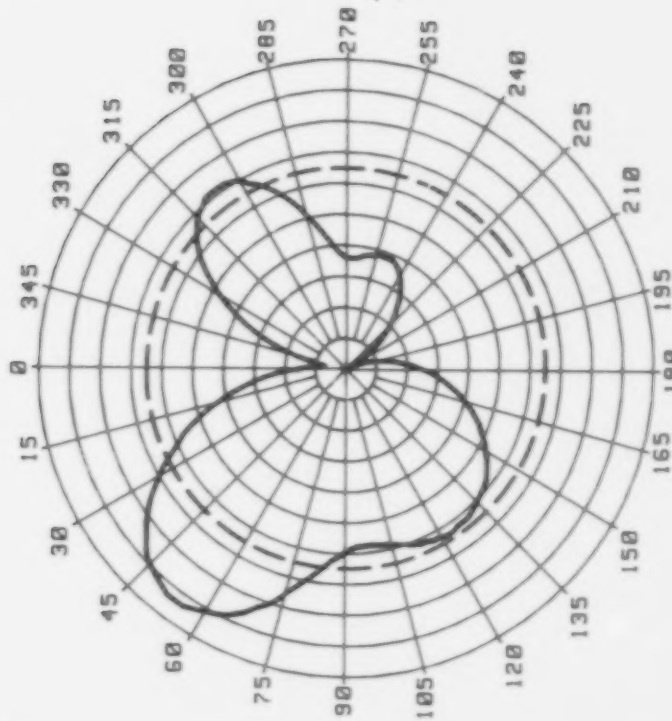
E-PHI

THE FULL-SCALE VALUE IS 1.54 [ISOTROPIC]
--- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 528.00 MHz
 CH-135 HELICOPTER 22.00 MHz
 YAW PLANE PATTERNS



E-THETA



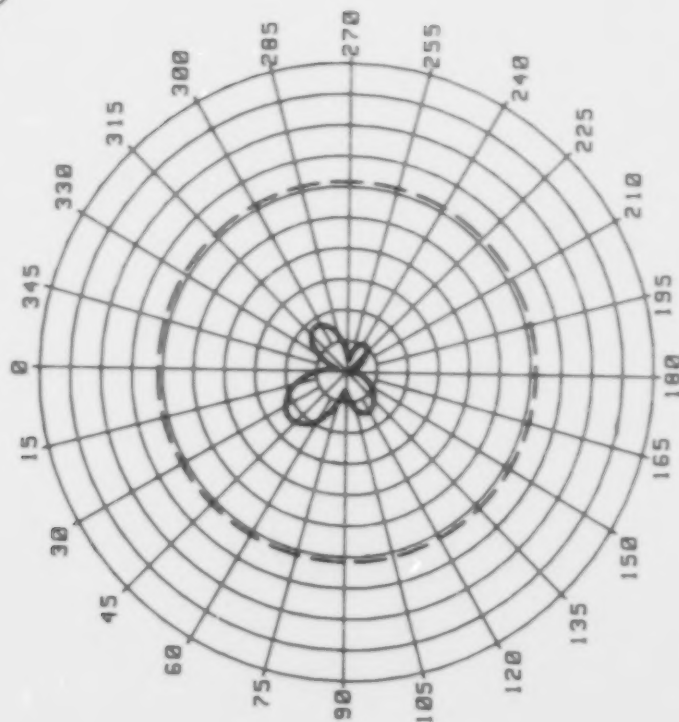
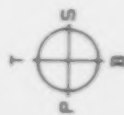
E-PHI

THE FULL-SCALE VALUE IS 1.54 [ISOTROPIC]
 --- ISOTROPIC LEVEL

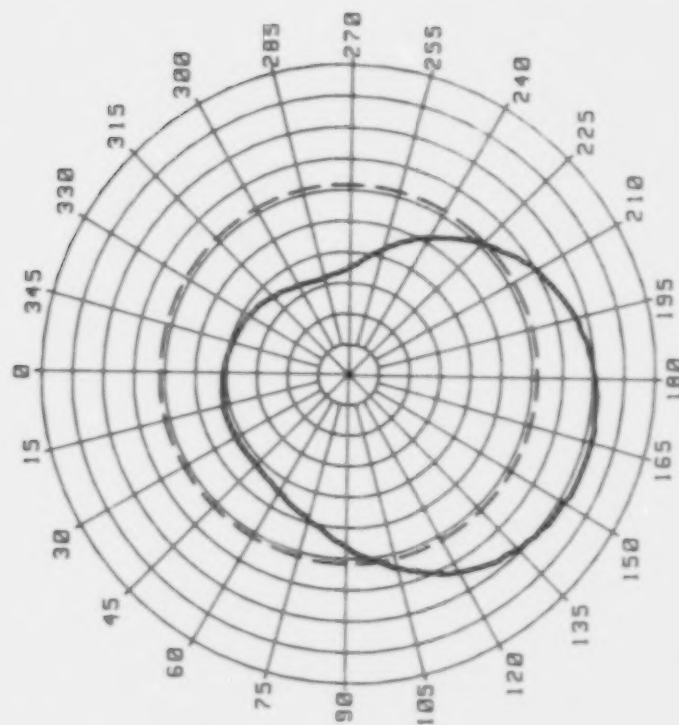
NRC ELECTROMAGNETIC ENGINEERING
 28 JAN 1986 08:21:43

COMPILED FROM VOLUME CH-8 FILE SPECIFIER A
 THE ISOTROPIC LEVEL HAS -4.01 dB

CH-135 MODEL HELICOPTER 552.00 MHz
 CH-135 HELICOPTER 23.00 MHz
 ROLL PLANE PATTERNS



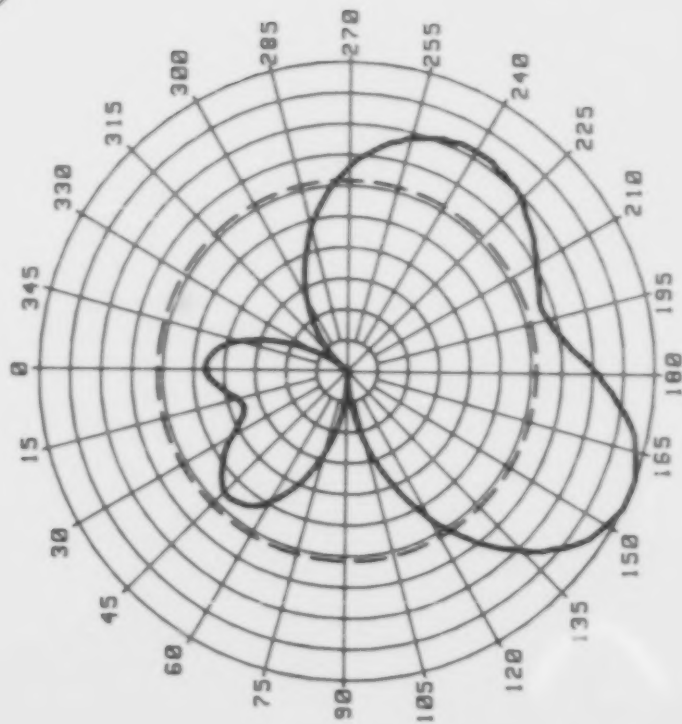
E-THETA



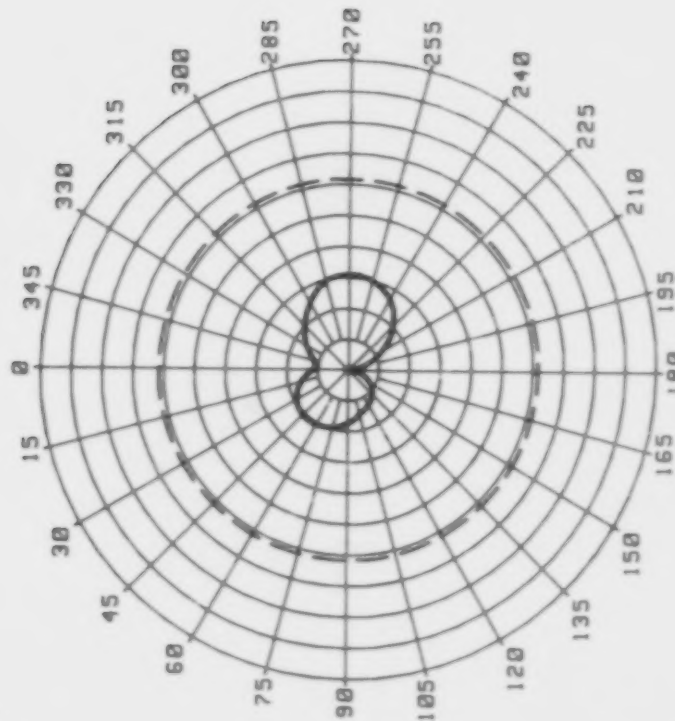
E-PHI

THE FULL-SCALE VALUE IS 1.62 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 552.00 MHz
CH-135 HELICOPTER 23.00 MHz
PITCH PLANE PATTERNS



E-THETA



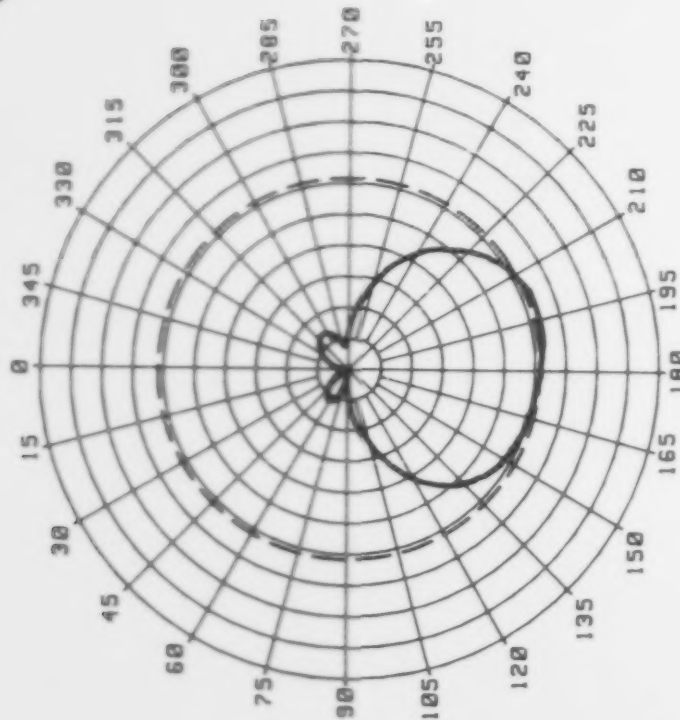
E-PHI

THE FULL-SCALE VALUE IS 1.62 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

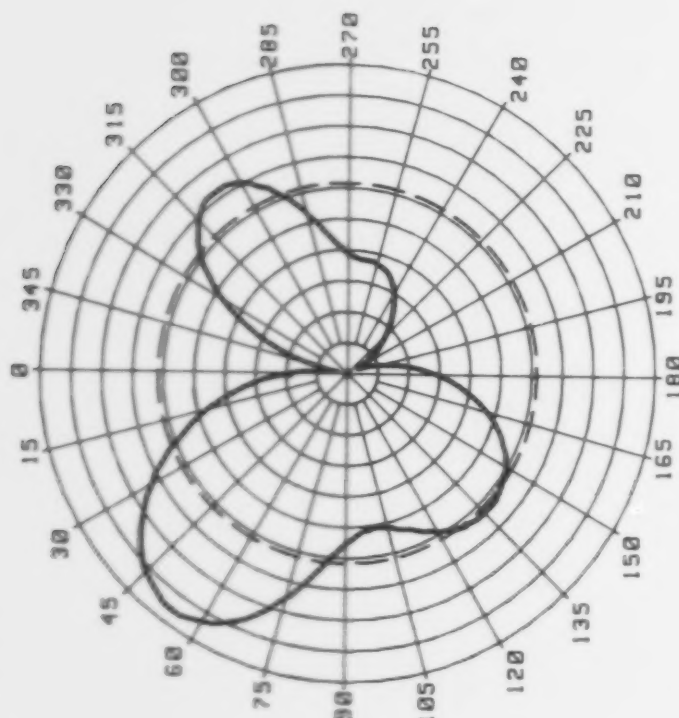
NSC ELECTROMAGNETIC ENGINEERING
20 JAN 1986 03:02:14

COMPILED FROM VOLUME 040 FILE SPECIFIER 4
THE ISOTROPIC LEVEL WAS -1.81 dB

CH-135 MODEL HELICOPTER 552.00 MHz
CH-135 HELICOPTER 23.00 MHz
YAW PLANE PATTERNS



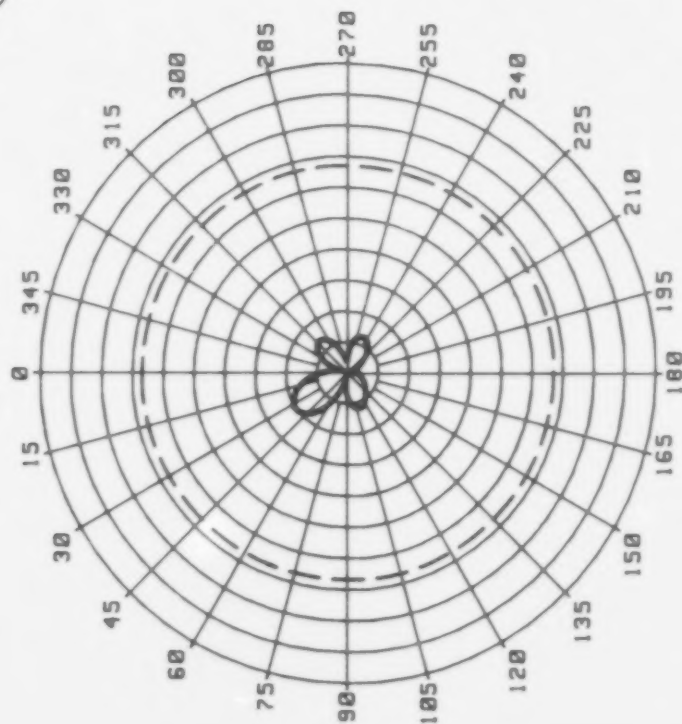
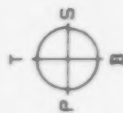
E-THETA



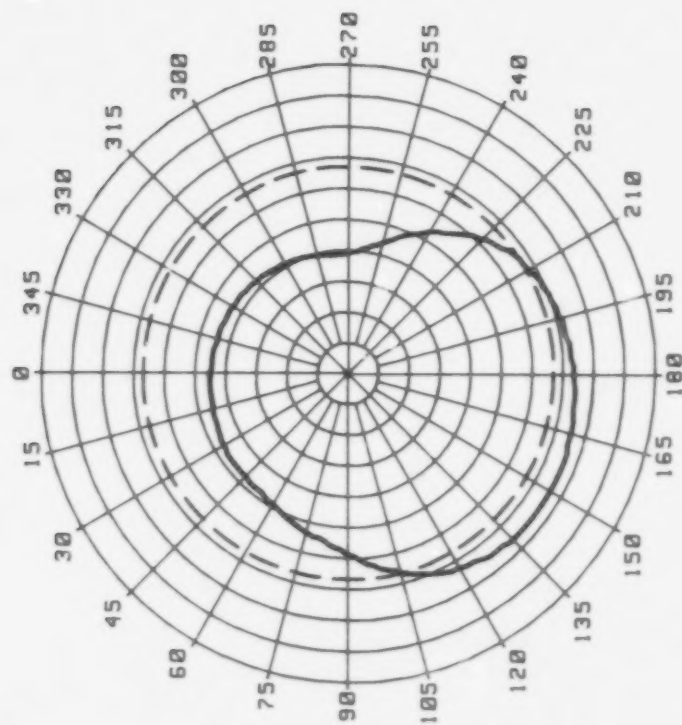
E-PHI

THE FULL-SCALE VALUE IS 1.62 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 576.00 MHz
CH-135 HELICOPTER 24.00 MHz
ROLL PLANE PATTERNS



E-THETA



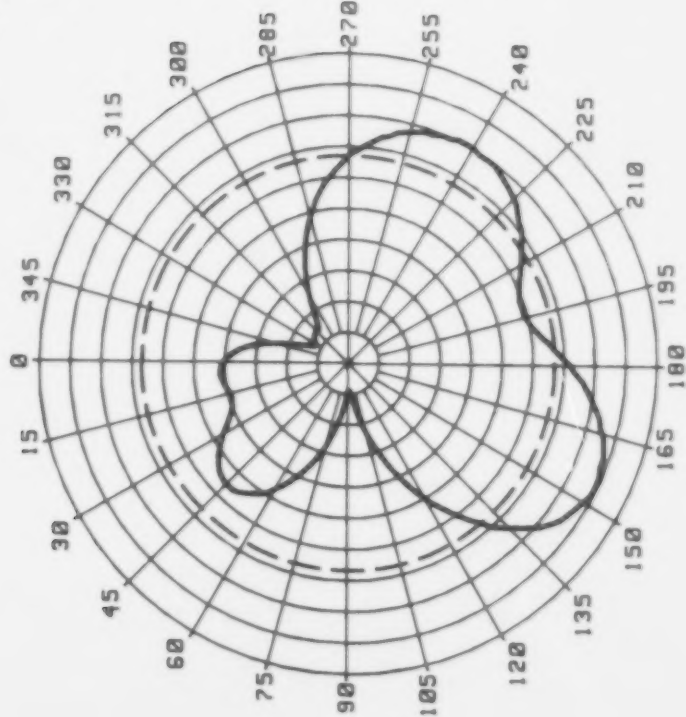
E-PHI

THE FULL-SCALE VALUE IS 1.50 [ISOTROPIC]
--- ISOTROPIC LEVEL

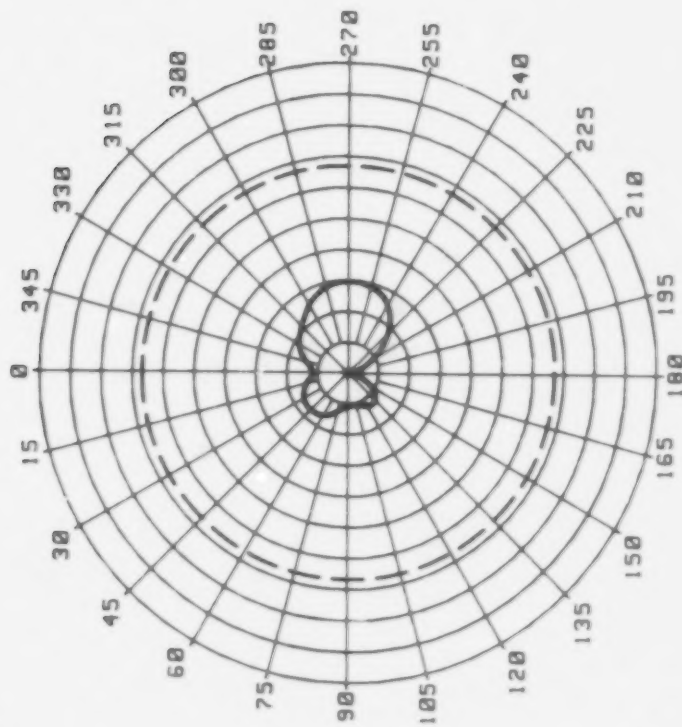
MPC ELECTROMAGNETIC ENGINEERING
22 JAN 1986 88:58:17

COMPILED FROM VOLUME ONE FILE SPECIFICATION -
THE ISOTROPIC LEVEL WAS -6.68 dB

CH-135 MODEL HELICOPTER 576.00 MHz
CH-135 HELICOPTER 24.00 MHz
PITCH PLANE PATTERNS



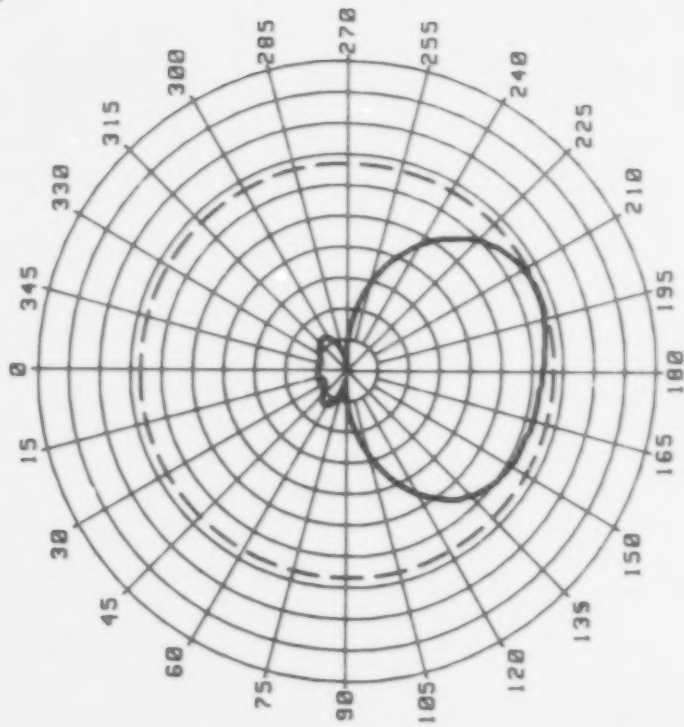
E-THETA



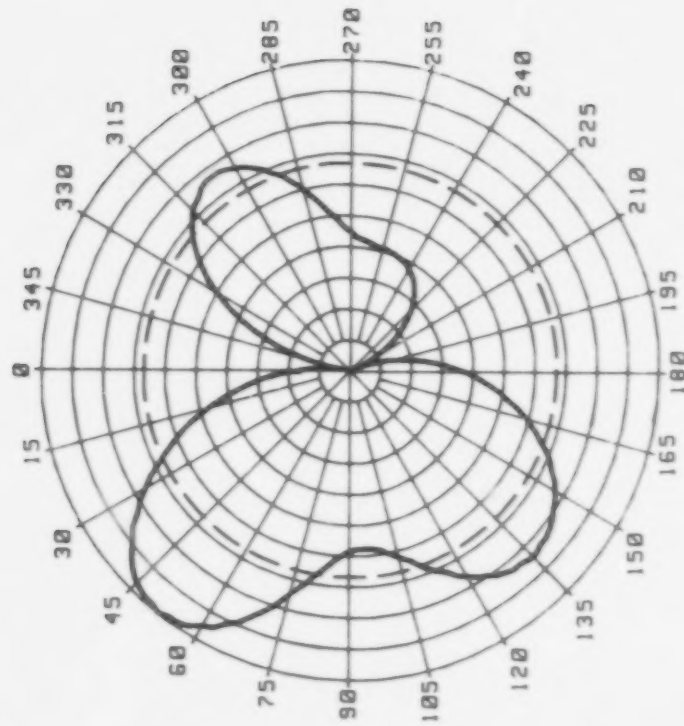
E-PHI

THE FULL-SCALE VALUE IS 1.50 [ISOTROPIC]
--- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 576.00 MHz
 CH-135 HELICOPTER 24.00 MHz
 YAW PLANE PATTERNS



E-THETA



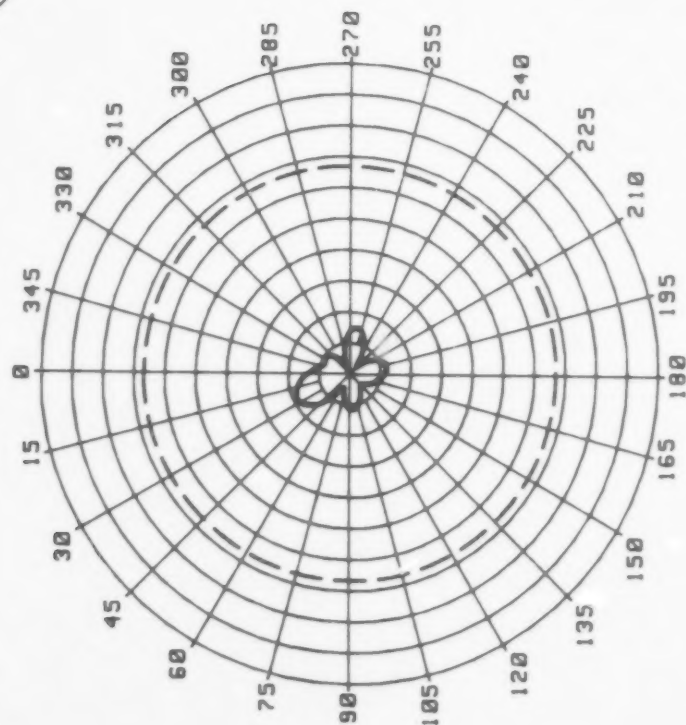
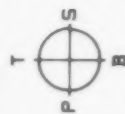
E-PHI

THE FULL-SCALE VALUE IS 1.50 (ISOTROPIC)
 --- ISOTROPIC LEVEL

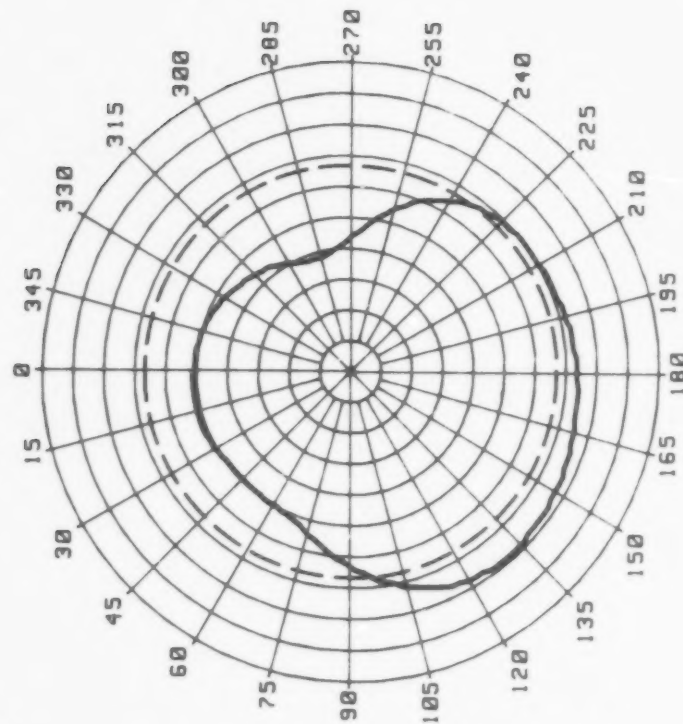
NBC ELECTROMAGNETIC ENGINEERING
22 JAN 1986 18:18:36

COMPILED FROM VOLUME C48 FILE SPECIFIER 4
THE ISOTROPIC LEVEL WAS -8.81 dB

CH-135 MODEL HELICOPTER 600.00 MHz
CH-135 HELICOPTER 25.00 MHz
ROLL PLANE PATTERNS



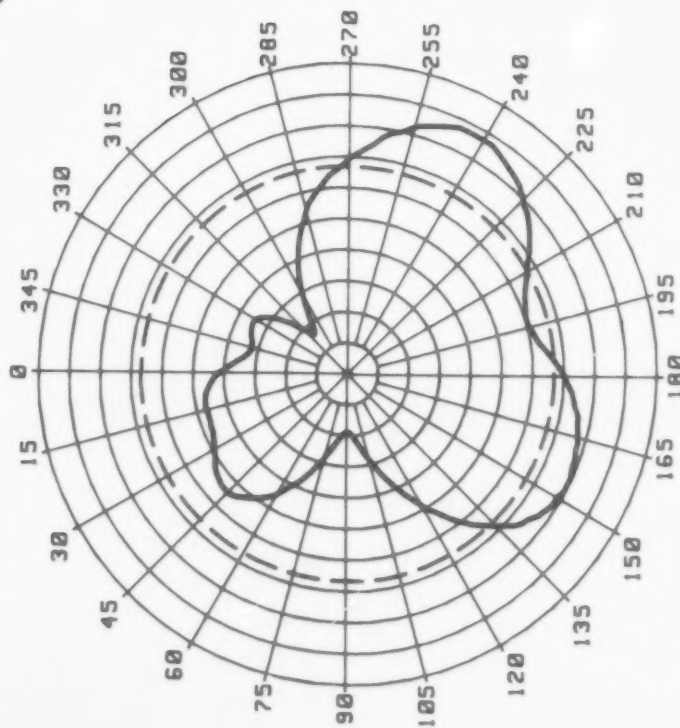
E-THETA



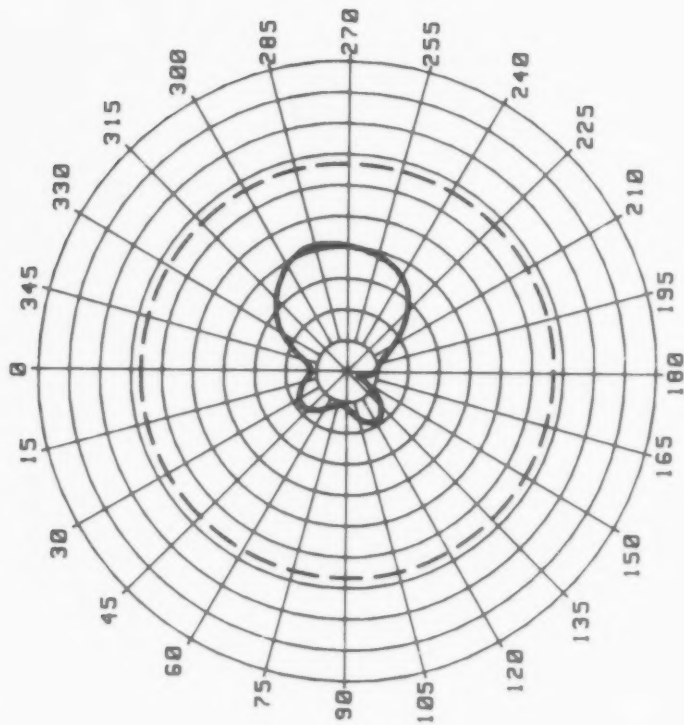
E-PHI

THE FULL-SCALE VALUE IS 1.50 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 600.00 MHz
CH-135 HELICOPTER 25.00 MHz
PITCH PLANE PATTERNS



E-THETA



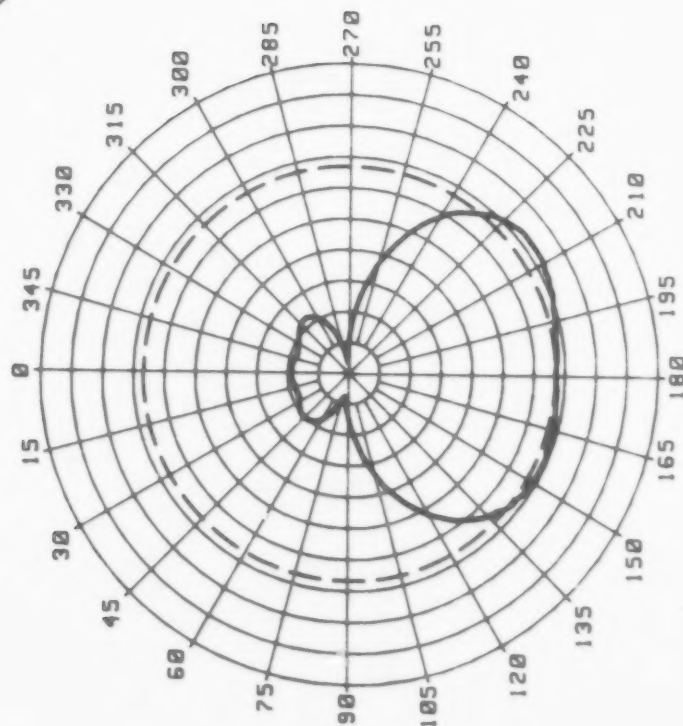
E-PHI

THE FULL-SCALE VALUE IS 1.50 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

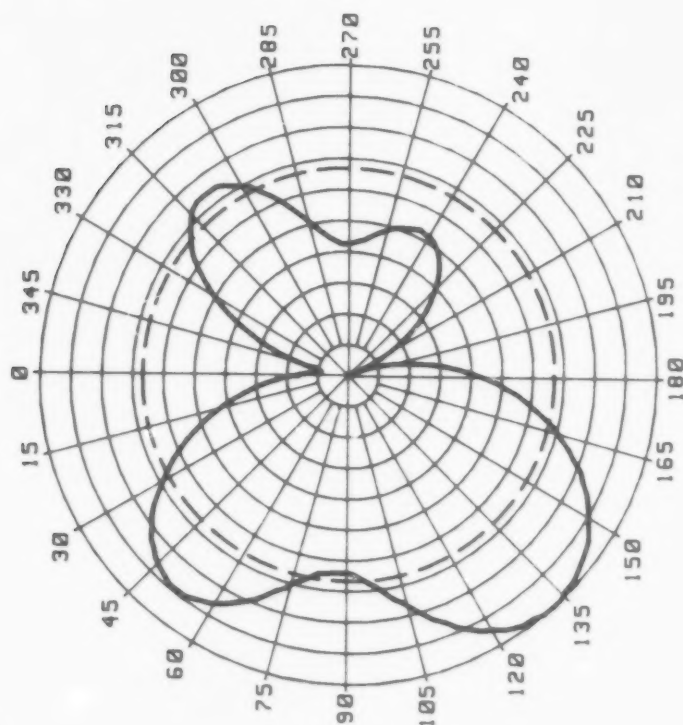
NBC ELECTROMAGNETIC ENGINEERING
28 JUN 1986 10:04:37

COMPILED FROM VOLUME CH8 FILE SPECIFIED *
THE ISOTROPIC LEVEL WAS -8.81 dB

CH-135 MODEL HELICOPTER 600.00 MHz
CH-135 HELICOPTER 25.00 MHz
YAW PLANE PATTERNS



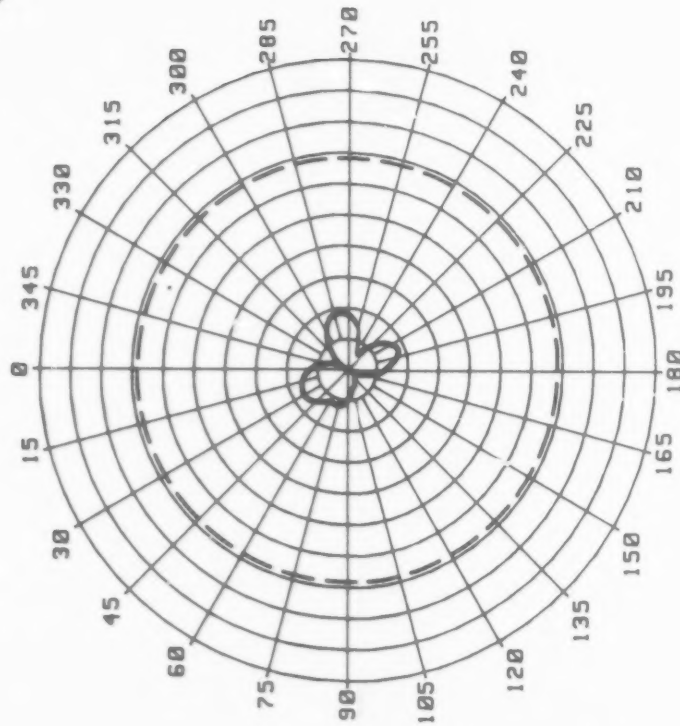
E-THETA



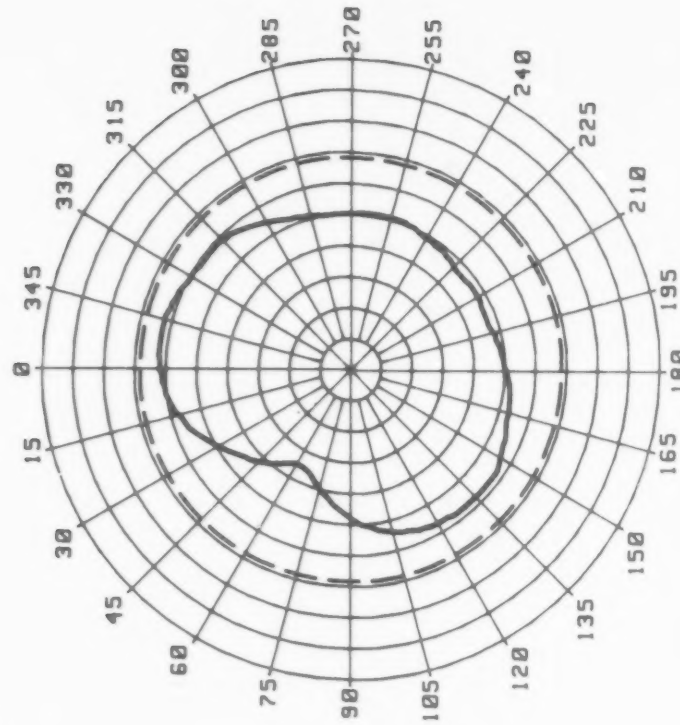
E-PHI

THE FULL-SCALE VALUE IS 1.50 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 624.00 MHz
CH-135 HELICOPTER 26.00 MHz
ROLL PLANE PATTERNS



E-THETA



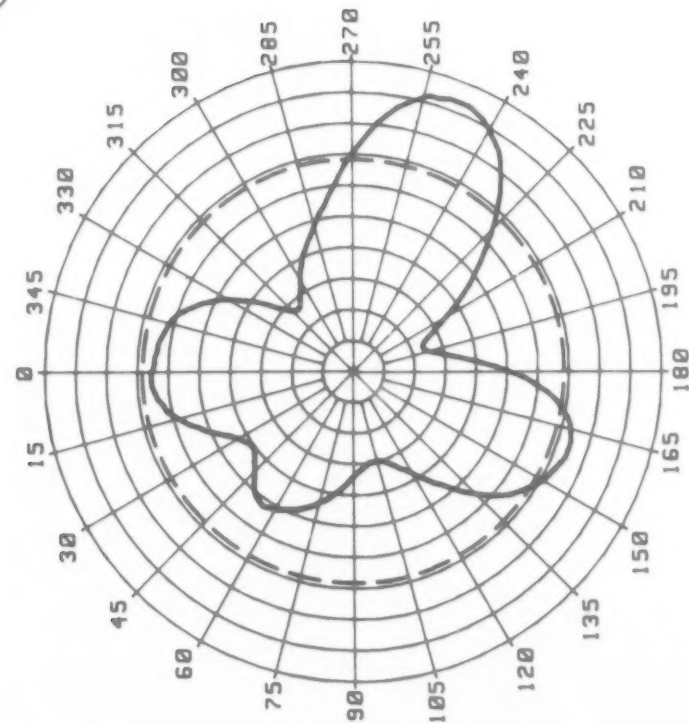
E-PHI

THE FULL-SCALE VALUE IS 1.47 [ISOTROPIC]
--- ISOTROPIC LEVEL

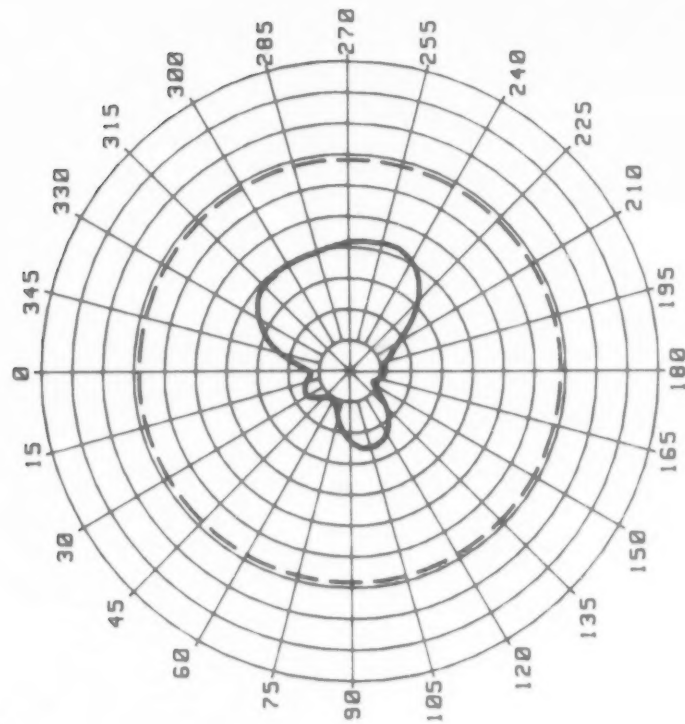
NRC ELECTROMAGNETIC ENGINEERING
 22 JAN 1986 18:24:28

COMPILED FROM VOLUME CH14 FILE SPECIFIER 4
 THE ISOTROPIC LEVEL WAS -6.82 dB

CH-135 MODEL HELICOPTER 624.00 MHz
 CH-135 HELICOPTER 26.00 MHz
 PITCH PLANE PATTERNS



E-THETA

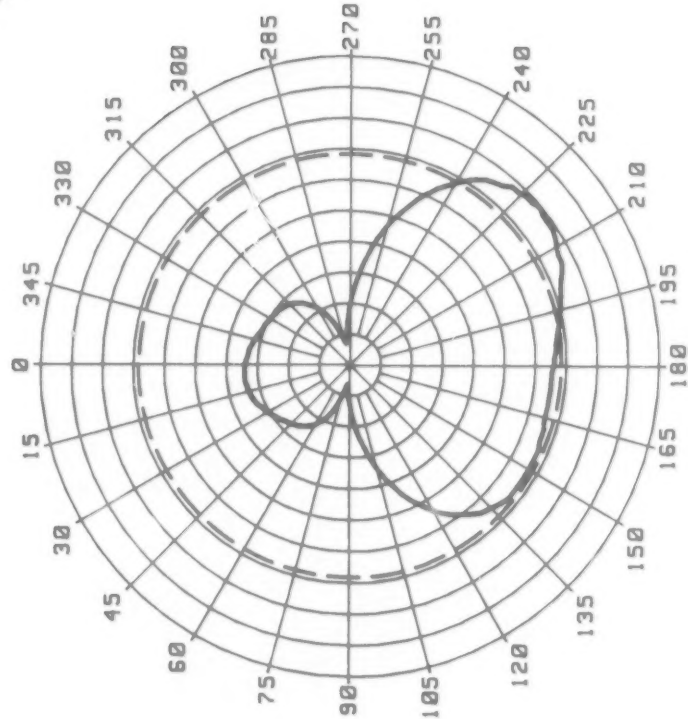
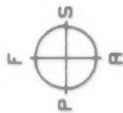


E-PHI

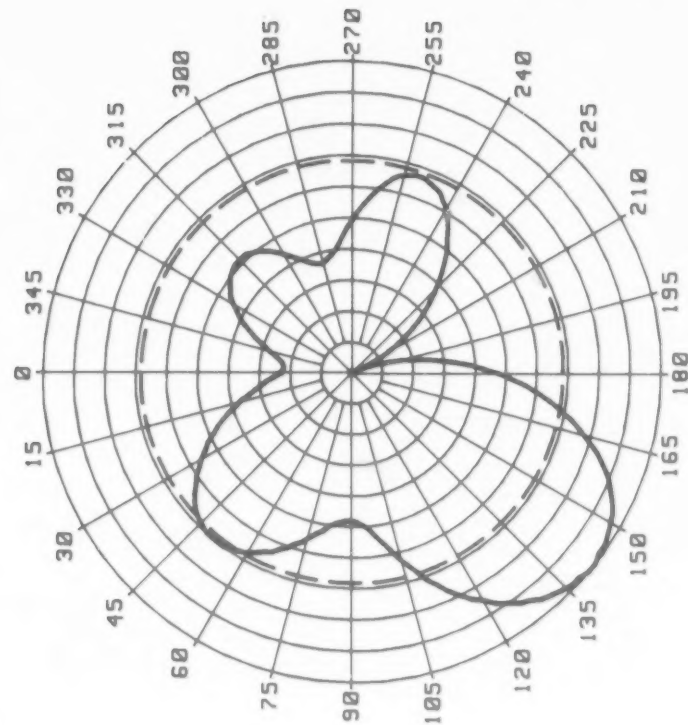
THE FULL-SCALE VALUE IS 1.47 [ISOTROPIC]

--- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 624.00 MHz
CH-135 HELICOPTER 26.00 MHz
YAW PLANE PATTERNS



E-THETA



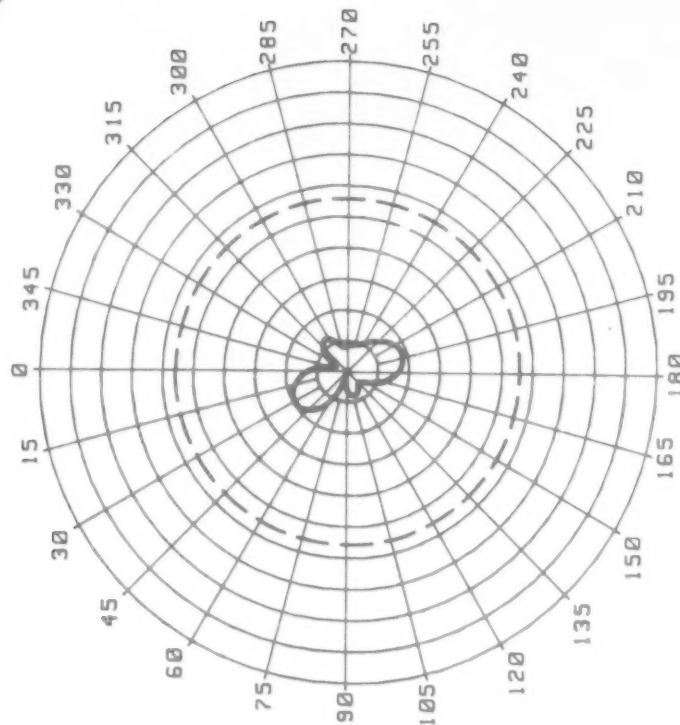
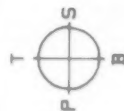
E-PHI

THE FULL-SCALE VALUE IS 1.47 [ISOTROPIC]
--- ISOTROPIC LEVEL

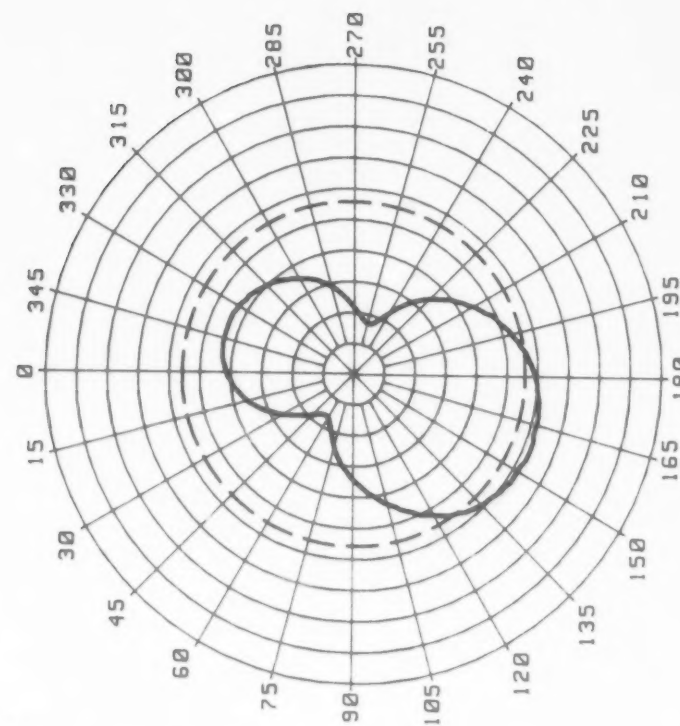
NBC ELECTROMAGNETIC ENGINEERING
22 JAN 1986 12:38:24

COMPILED FROM VOLUME ONE FILE SPECIFIER
THE ISOTROPIC LEVEL WAS -6.18 dB

CH-135 MODEL HELICOPTER 648.00 MHz
CH-135 HELICOPTER 27.00 MHz
ROLL PLANE PATTERNS



E-THETA



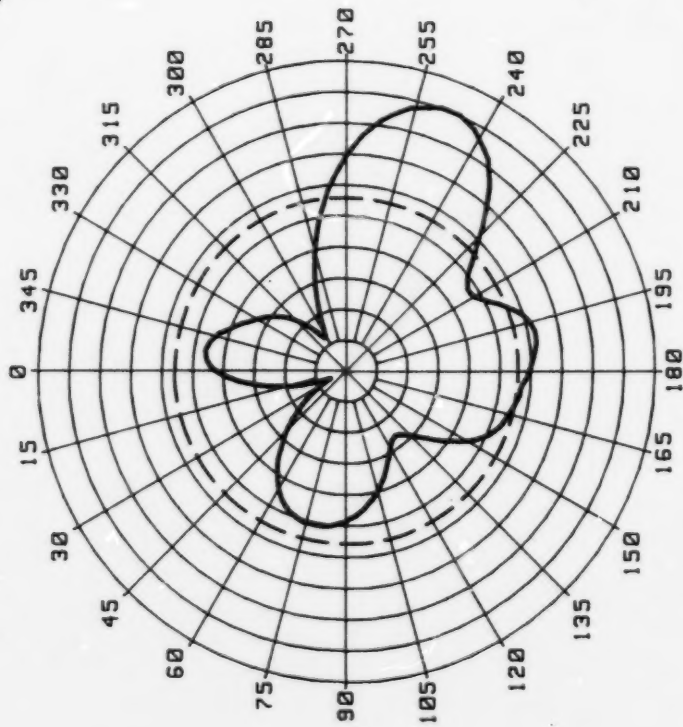
E-PHI

THE FULL-SCALE VALUE IS 1.79 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

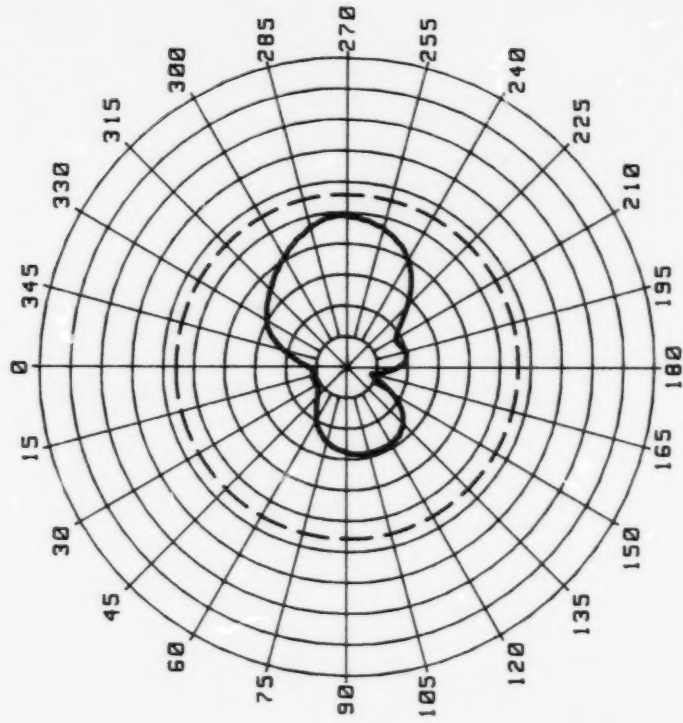
HMC ELECTROMAGNETIC ENGINEERING
22 JUN 1986 12:44:11

COMPILED FROM VOLUME CH-135 FILE SPECIFIC
THE ISOTROPIC LEVEL WAS -8.18 dB

CH-135 MODEL HELICOPTER 648.00 MHz
CH-135 HELICOPTER 27.00 MHz
PITCH PLANE PATTERNS



E-THETA



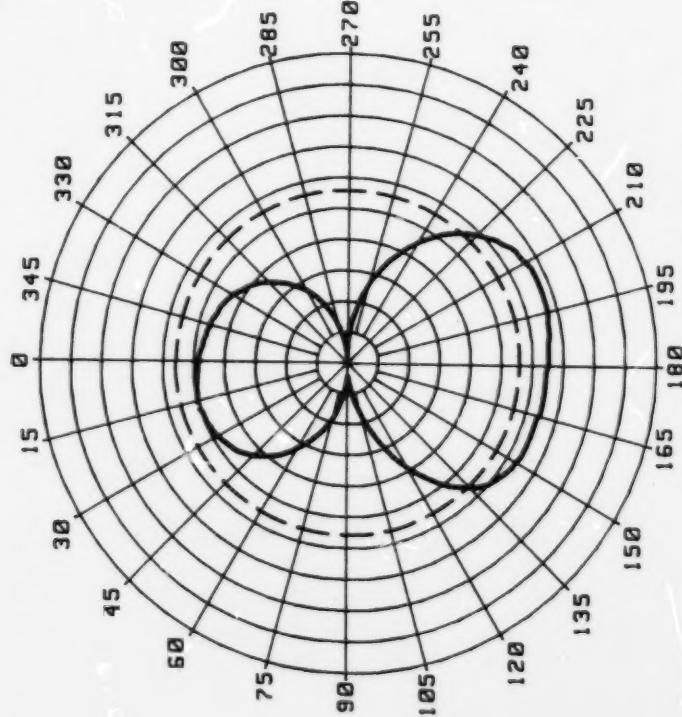
E-PHI

THE FULL-SCALE VALUE IS 1.79 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

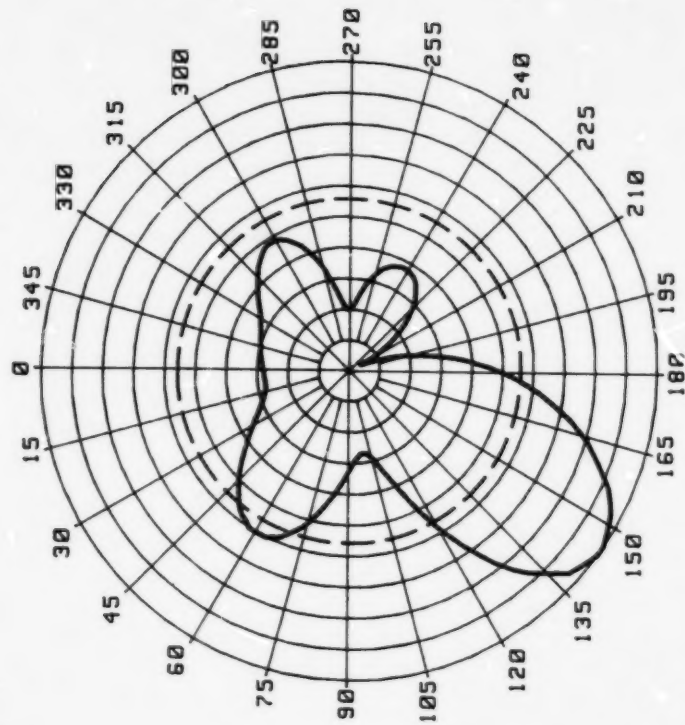
HMC ELECTROMAGNETIC ENGINEERING
22 JAN 1986 12:05:39

COMPILED FROM VOLUME ONE FILE SPECIFICATION
THE ISOTROPIC LEVEL WAS -8.18 dB

CH-135 MODEL HELICOPTER 648.00 MHz
CH-135 HELICOPTER 27.00 MHz
YAW PLANE PATTERNS



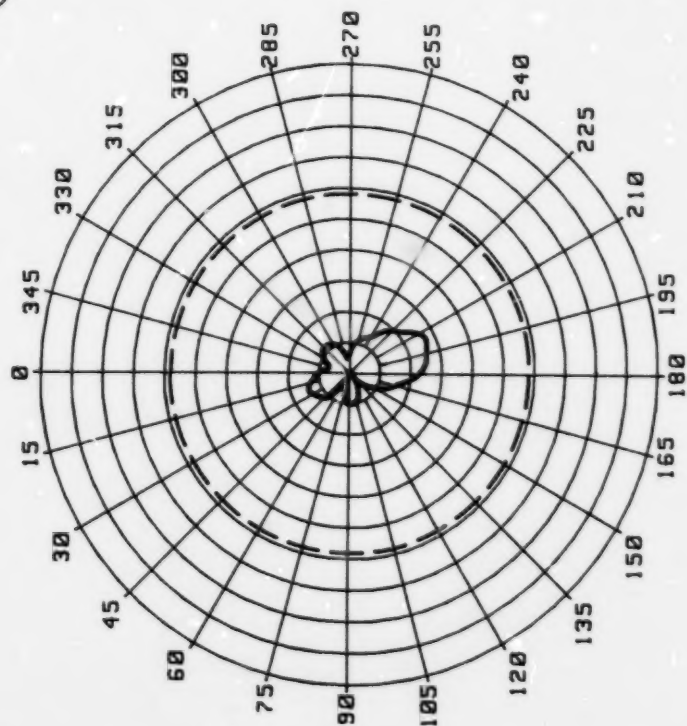
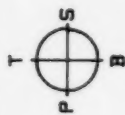
E-THETA



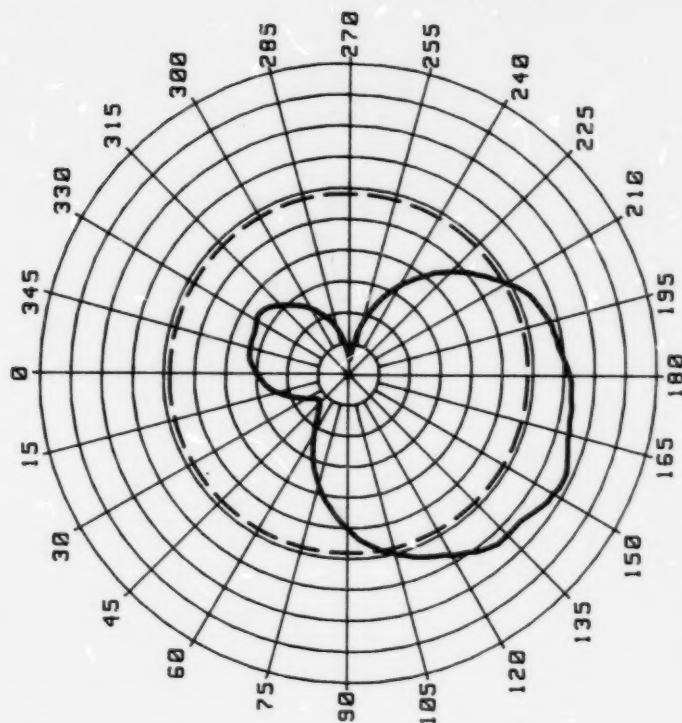
E-PHI

THE FULL-SCALE VALUE IS 1.79 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 672.00 MHz
 CH-135 HELICOPTER 28.00 MHz
 ROLL PLANE PATTERNS



E-THETA



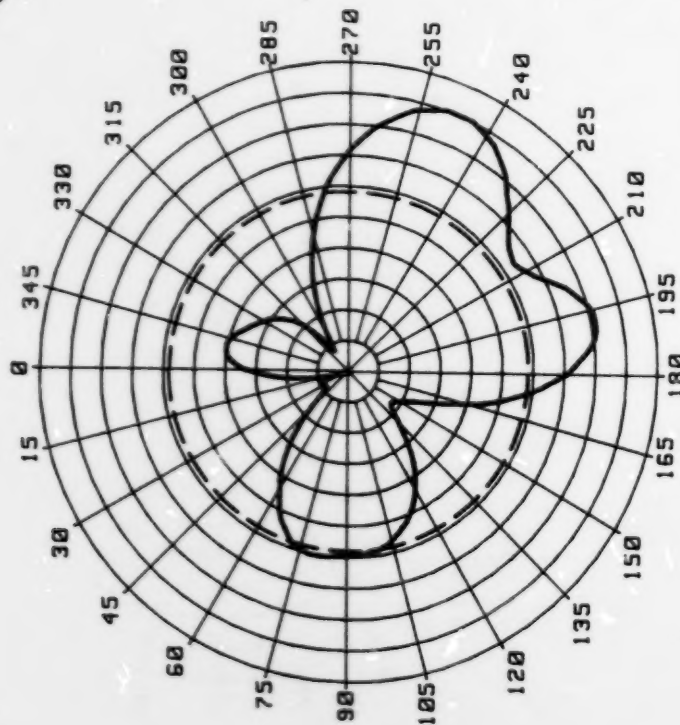
E-PHI

THE FULL-SCALE VALUE IS 1.72 [ISOTROPIC]
 --- ISOTROPIC LEVEL

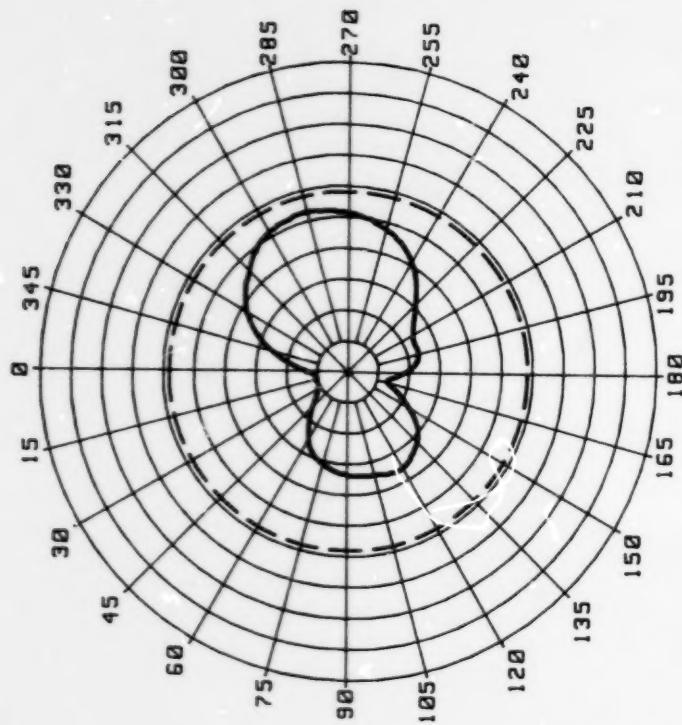
NRC ELECTROMAGNETIC ENGINEERING
22 JUN 1966 13:13:28

COMPILED FROM VOLUME CH13 FILE SPECIFICATION U
THE ISOTROPIC LEVEL WAS -7.18 dB

CH-135 MODEL HELICOPTER 672.00 MHz
CH-135 HELICOPTER 28.00 MHz
PITCH PLANE PATTERNS



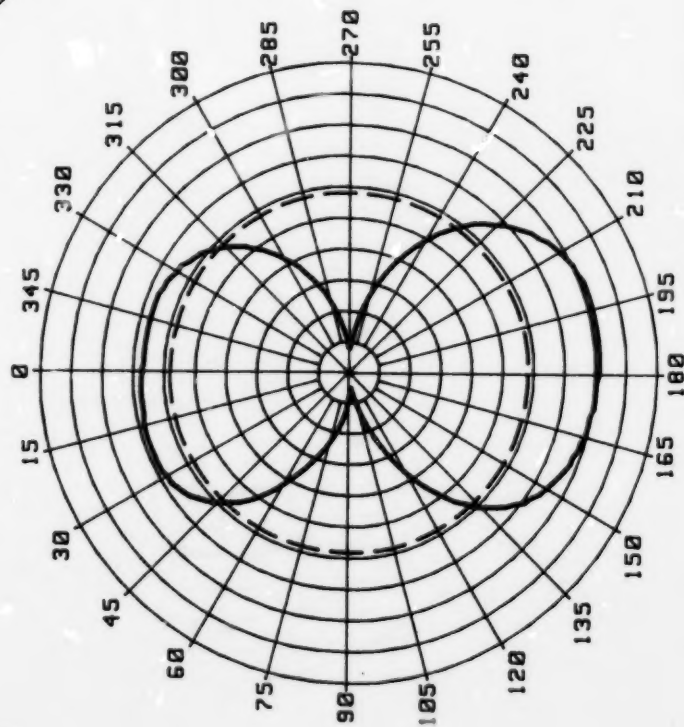
E-THETA



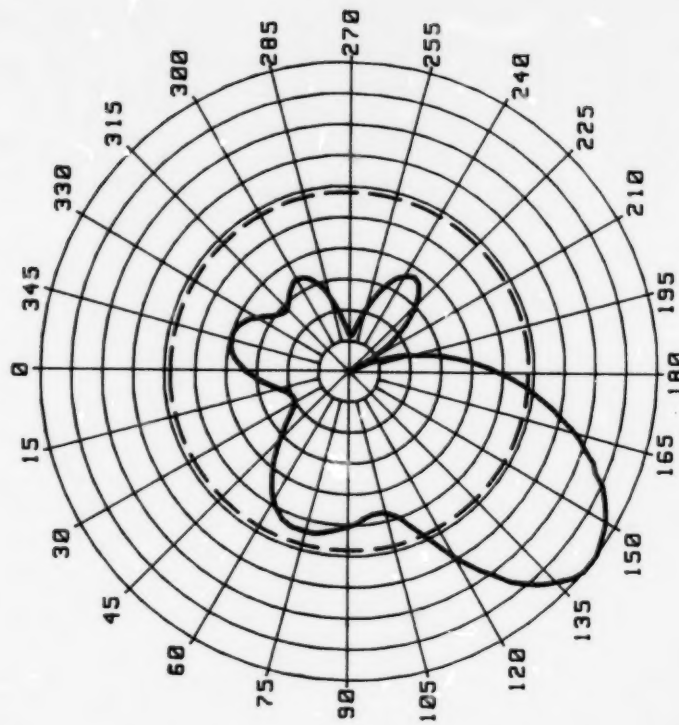
E-PHI

THE FULL-SCALE VALUE IS 1.72 [ISOTROPIC]
--- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 672.00 MHz
 CH-135 HELICOPTER 28.00 MHz
 YAW PLANE PATTERNS



E-THETA



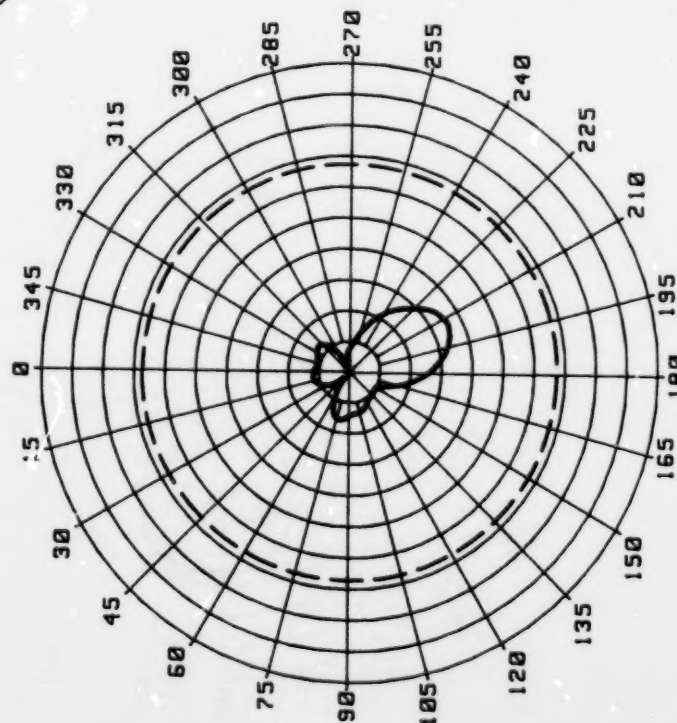
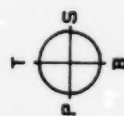
E-PHI

THE FULL-SCALE VALUE IS 1.72 [ISOTROPIC]
 --- ISOTROPIC LEVEL

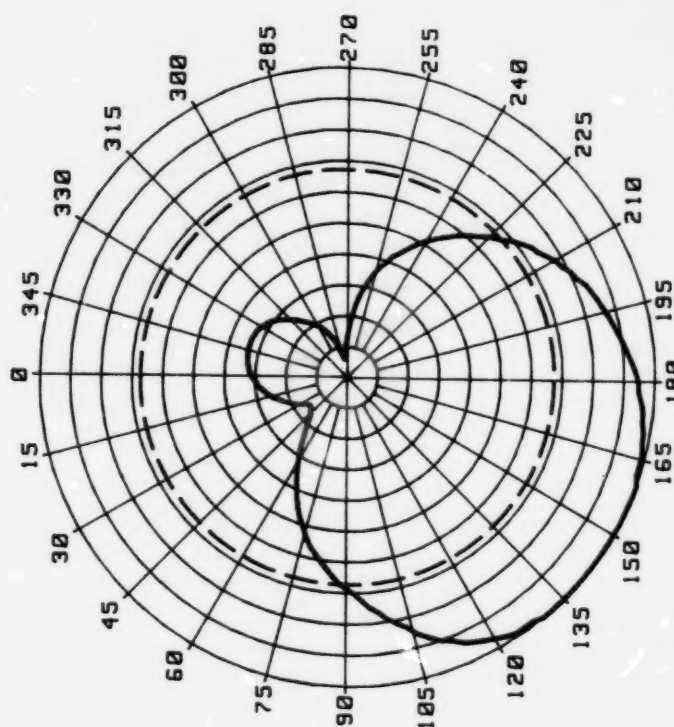
NRC ELECTROMAGNETIC ENGINEERING
 22 JAN 1986 13:27:56

COMPILED FROM VOLUME CH7 FILE SPECIFIER *
 THE ISOTROPIC LEVEL WAS -7.15 dB

CH-135 MODEL HELICOPTER 696.00 MHz
 CH-135 HELICOPTER 29.00 MHz
 ROLL PLANE PATTERNS



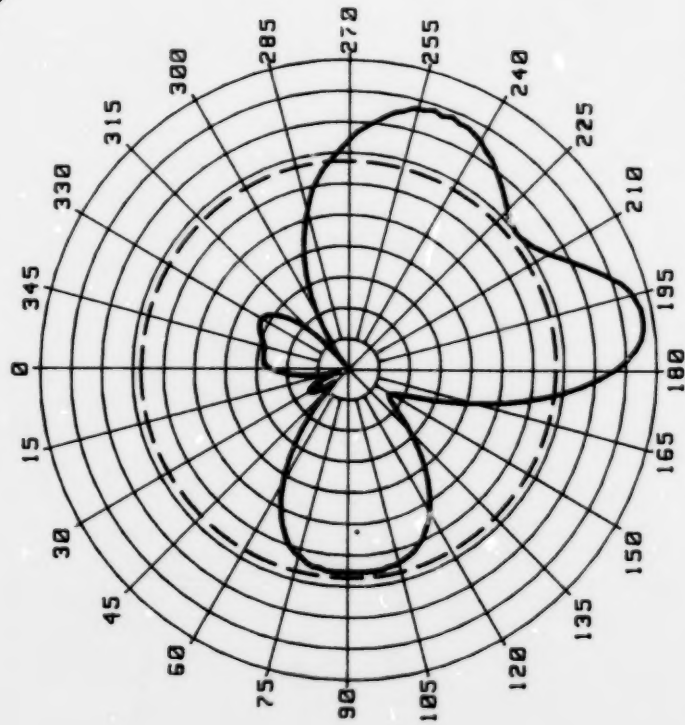
E-THETA



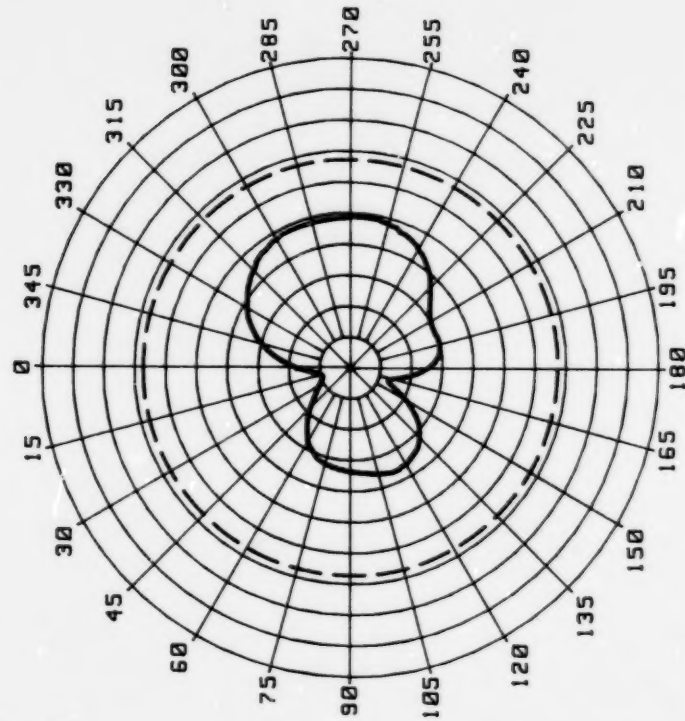
E-PHI

THE FULL-SCALE VALUE IS 1.49 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 696.00 MHz
CH-135 HELICOPTER 29.00 MHz
PITCH PLANE PATTERNS



E-THETA



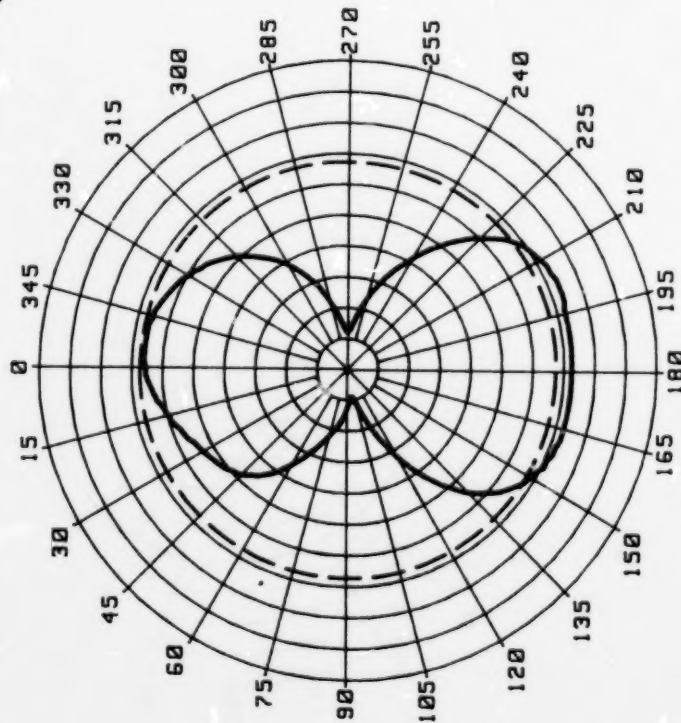
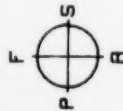
E-PHI

THE FULL-SCALE VALUE IS 1.49 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

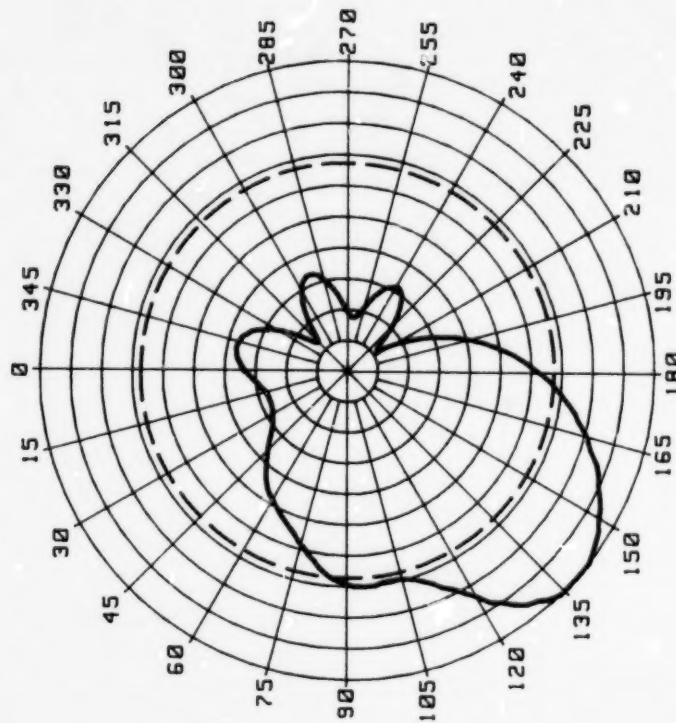
NRC ELECTROMAGNETIC ENGINEERING
28 JUN 1986 13121158

COMPILED FROM VOLUME CH7 FILE SPECIFICATION 4
THE ISOTROPIC LEVEL WAS -7.15 dB

CH-135 MODEL HELICOPTER 696.00 MHz
CH-135 HELICOPTER 29.00 MHz
YAW PLANE PATTERNS



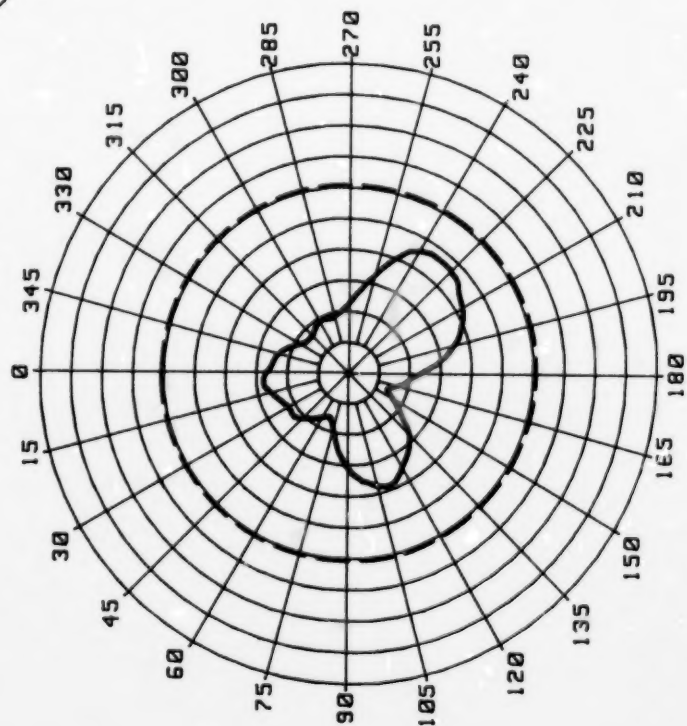
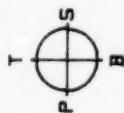
E-THETA



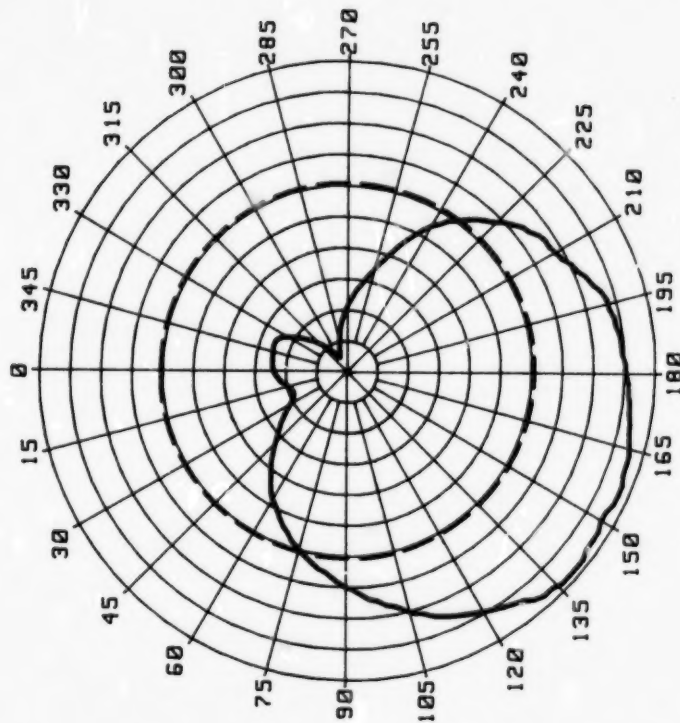
E-PHI

THE FULL-SCALE VALUE IS 1.49 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 720.00 MHz
 CH-135 HELICOPTER 30.00 MHz
 ROLL PLANE PATTERNS



E-THETA



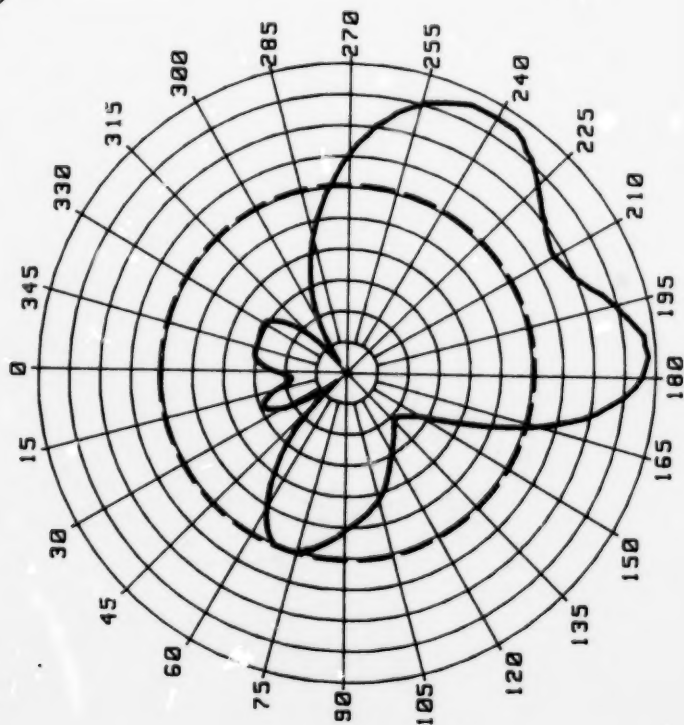
E-PHI

THE FULL-SCALE VALUE IS 1.65 [ISOTROPIC]
 --- ISOTROPIC LEVEL

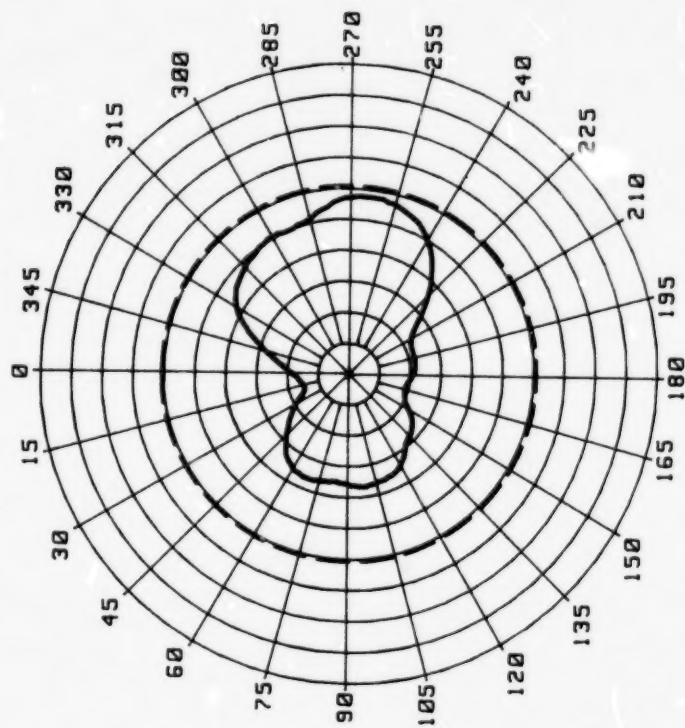
NBC ELECTROMAGNETIC ENGINEERING
28 JUN 1986 13:56:58

COMPILED FROM VOLUME CH13 FILE SPECIFIER Y
THE ISOTROPIC LEVEL WAS -6.53 dB

CH-135 MODEL HELICOPTER 720.00 MHz
CH-135 HELICOPTER 30.00 MHz
PITCH PLANE PATTERNS



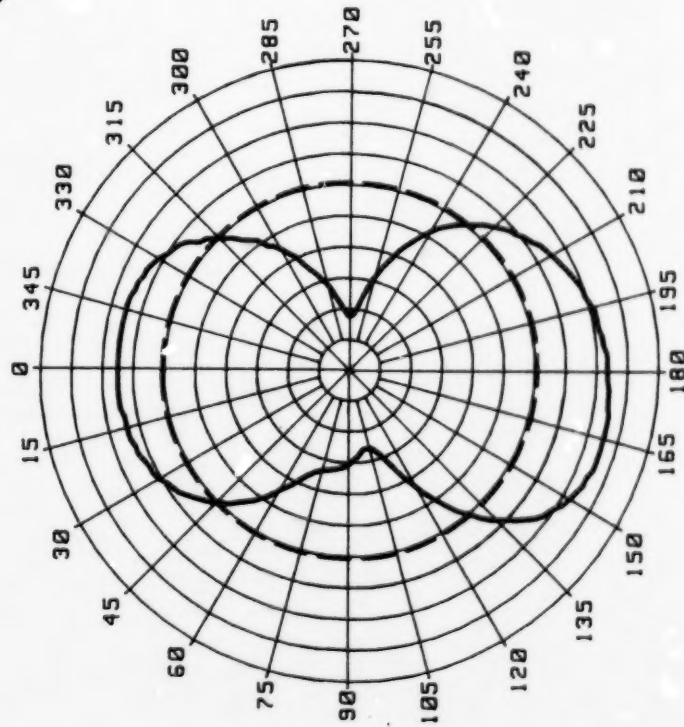
E-THETA



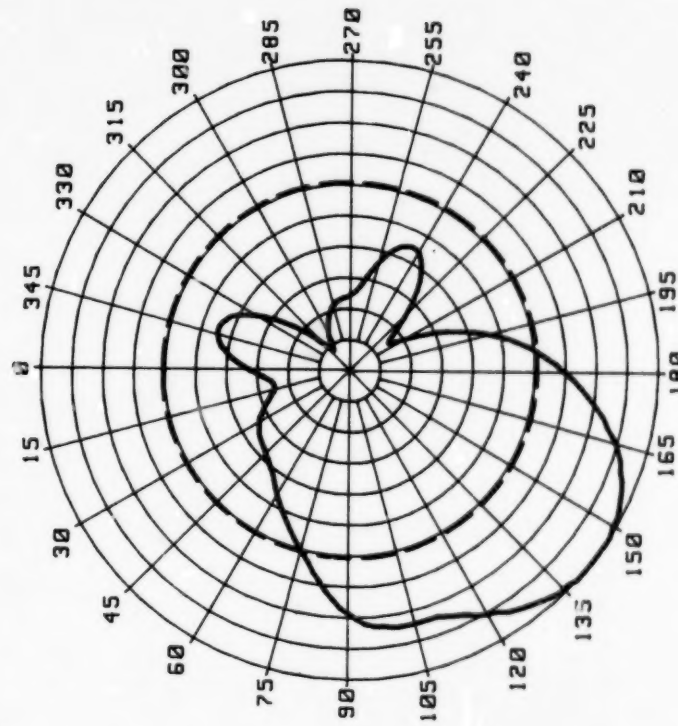
E-PHI

THE FULL-SCALE VALUE IS 1.65 [ISOTROPIC]
---- ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 720.00 MHz
CH-135 HELICOPTER 30.00 MHz
YAW PLANE PATTERNS



E-THETA



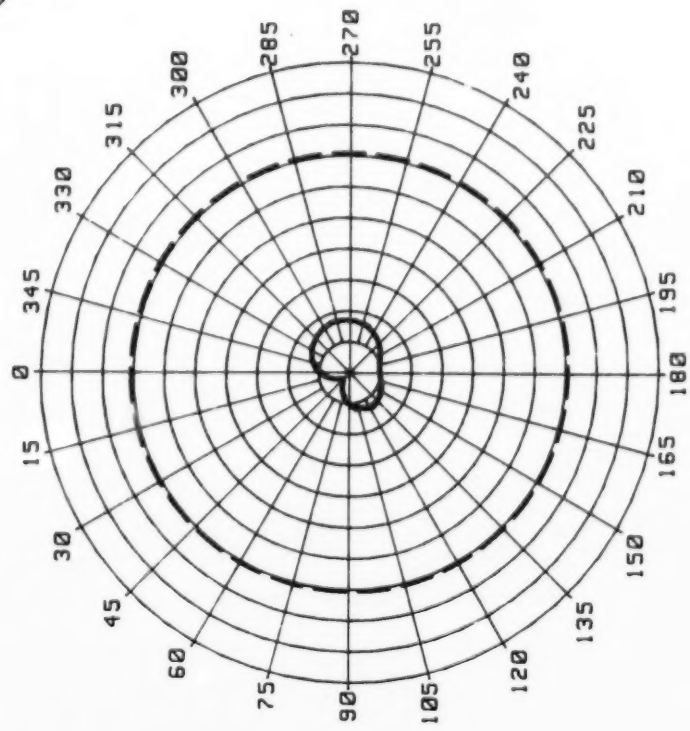
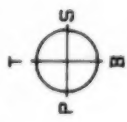
E-PHI

THE FULL-SCALE VALUE IS 1.65 [ISOTROPIC]
--- ISOTROPIC LEVEL

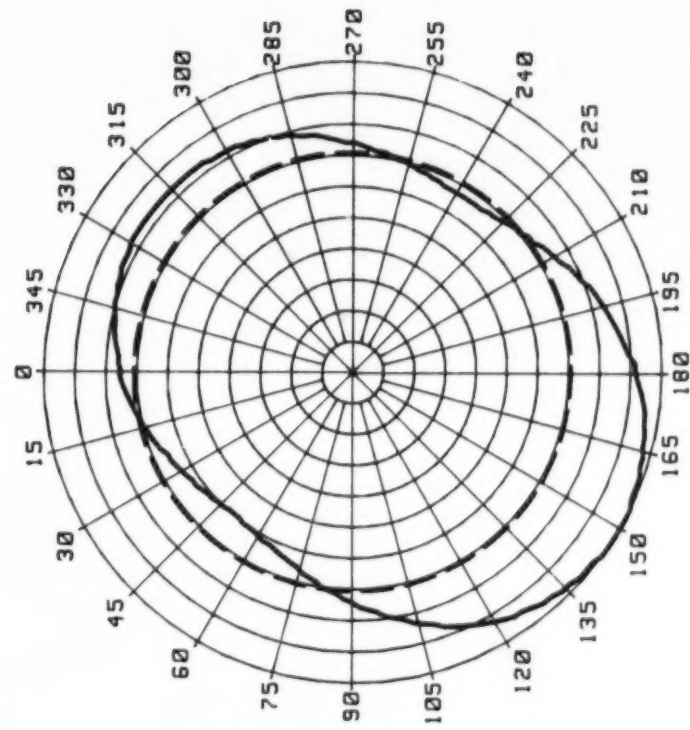
(b) ROLL, PITCH, and YAW PLANE PATTERNS
3 TO 29 MHz IN 2 MHz STEPS
ROTOR IN PORT-STARBOARD POSITION

These patterns are presented on a linearly scaled polar format. All patterns for a particular frequency are drawn such that the maximum amplitude measured at that frequency is the full-scale value; the isotropic level is shown with a broken line. A position diagram showing helicopter bearings appears below each main title.

CH-135 MODEL HELICOPTER 72.00 MHz
CH-135 HELICOPTER 3.00 MHz
ROLL PLANE PATTERNS



E-THETA



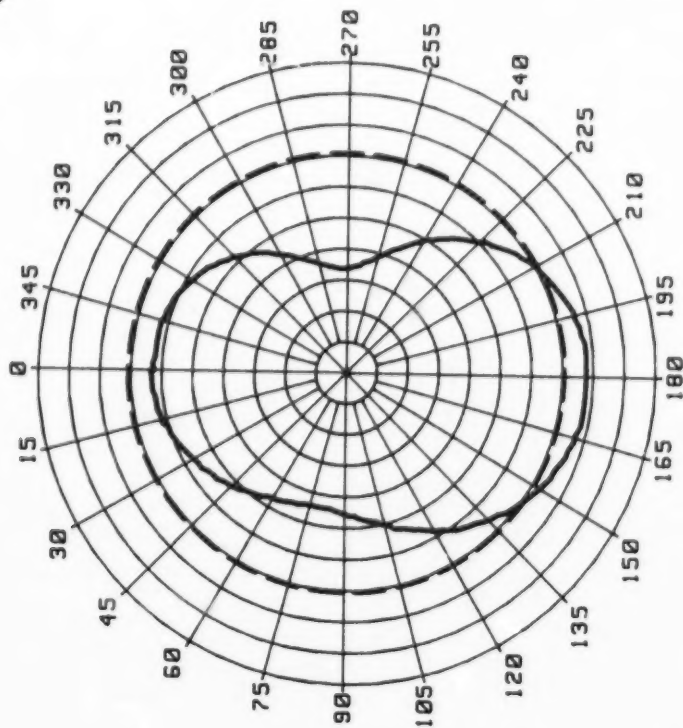
E-PHI

THE FULL-SCALE VALUE IS 1.41 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

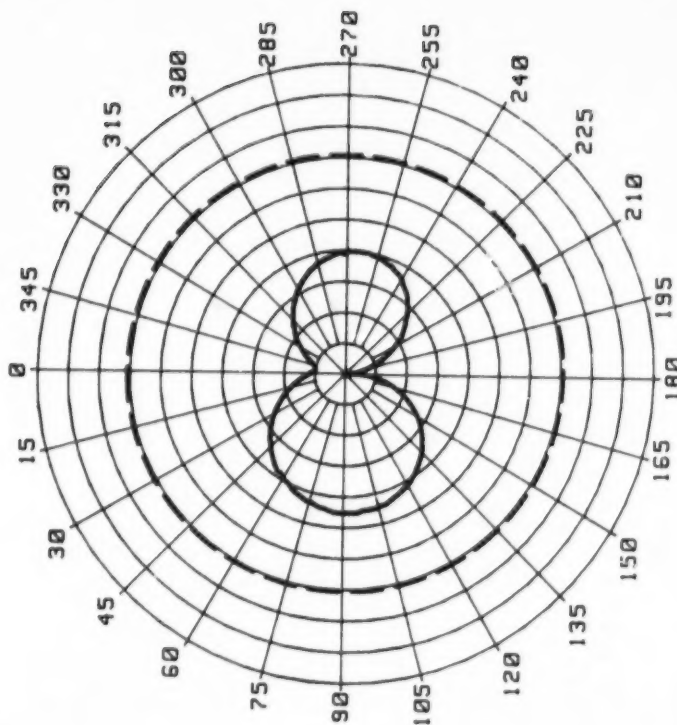
NRC ELECTROMAGNETIC ENGINEERING
6 FEB 1986 16:48:34

COMPILED FROM VOLUME ONE FILE SPECIFIER 6
THE ISOTROPIC LEVEL NRC -4.88 dB
MOTOR P/S

CH-135 MODEL HELICOPTER 72.00 MHz
CH-135 HELICOPTER 3.00 MHz
PITCH PLANE PATTERNS



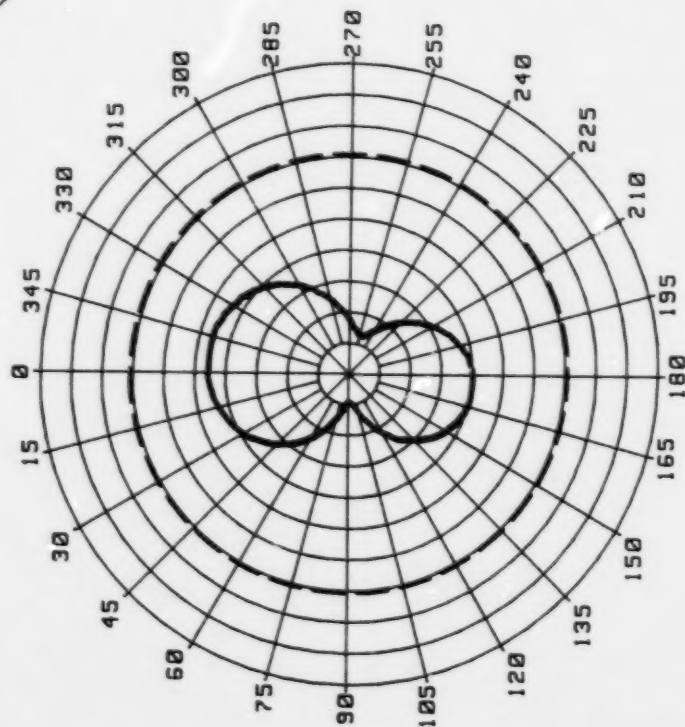
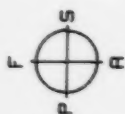
E-THETA



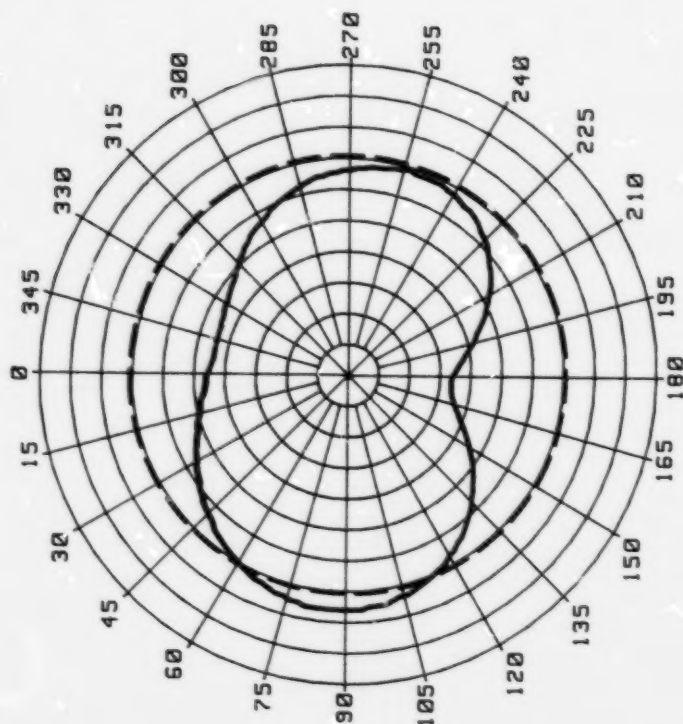
E-PHI

THE FULL-SCALE VALUE IS 1.41 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 72.00 MHz
CH-135 HELICOPTER 3.00 MHz
YAW PLANE PATTERNS



E-THETA



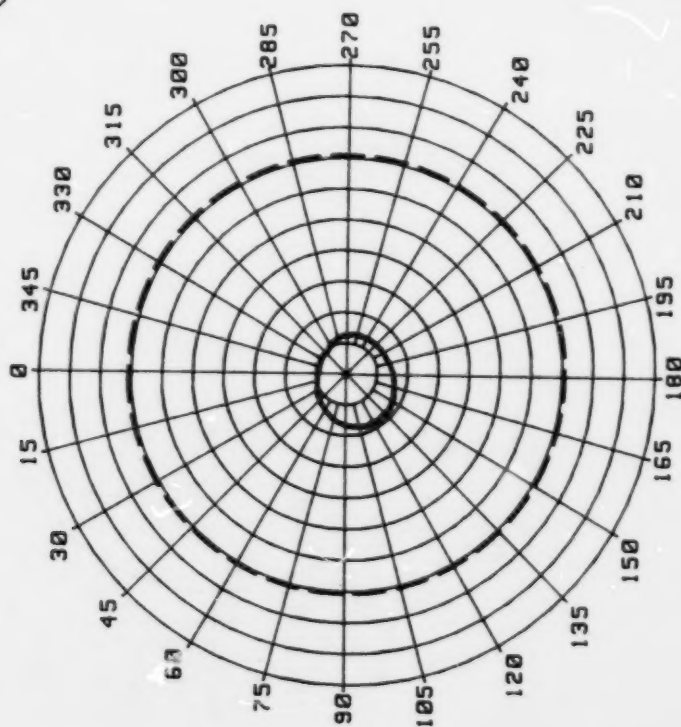
E-PHI

THE FULL-SCALE VALUE IS 1.41 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

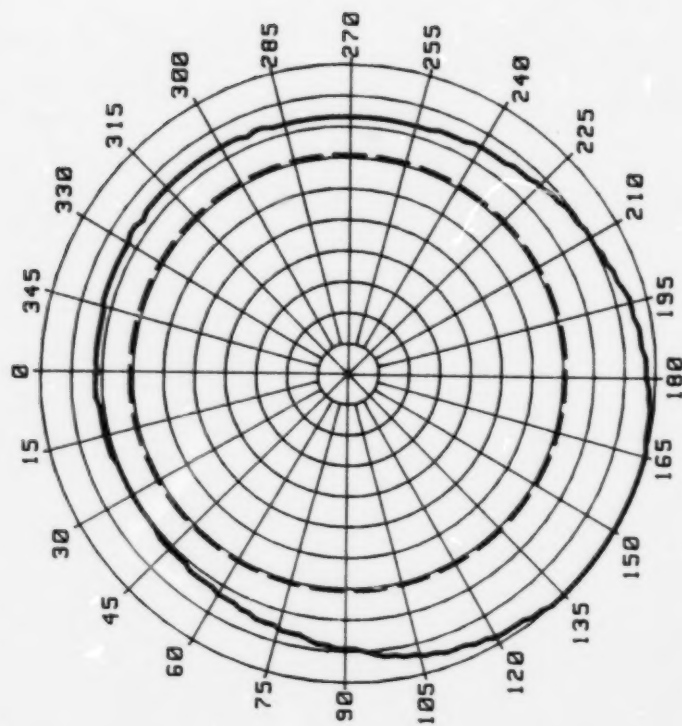
HMC ELECTROMAGNETIC ENGINEERING
 6 FEB 1986 15:33:57

COMPILED FROM VOLUME CH1 FILE SPECIFICATION A1
 THE ISOTROPIC LEVEL HAS -3.00 dB
 ROTOR P/S

CH-135 MODEL HELICOPTER 120.00 MHz
 CH-135 HELICOPTER 5.00 MHz
 ROLL PLANE PATTERNS



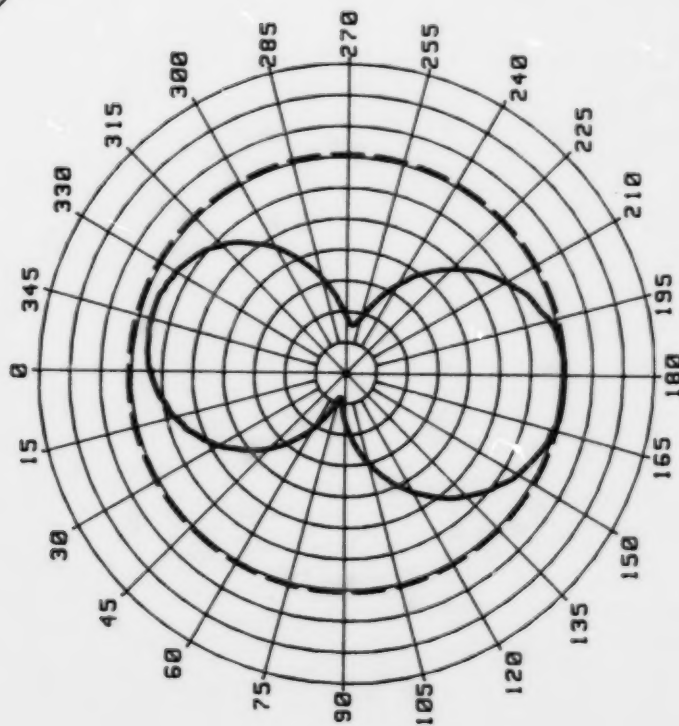
E-THETA



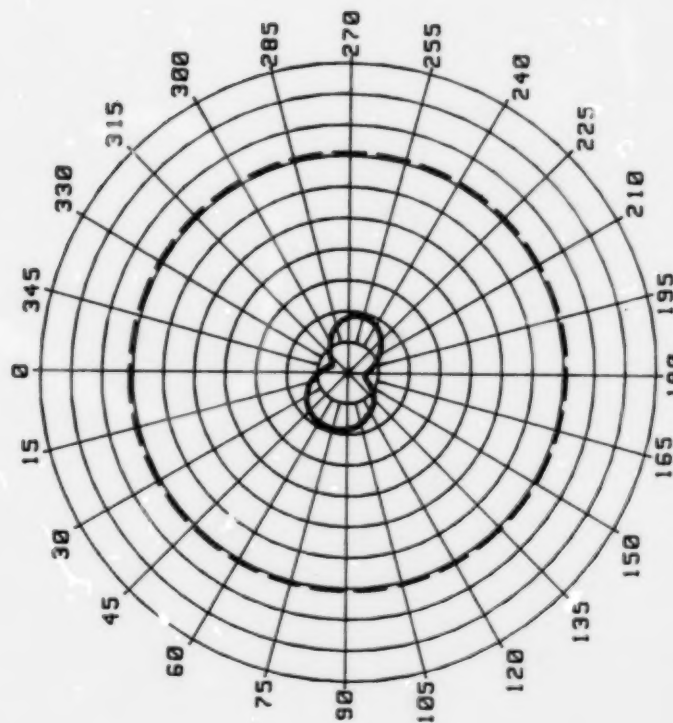
E-PHI

THE FULL-SCALE VALUE IS 1.41 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 120.00 MHz
 CH-135 HELICOPTER 5.00 MHz
 PITCH PLANE PATTERNS



E-THETA



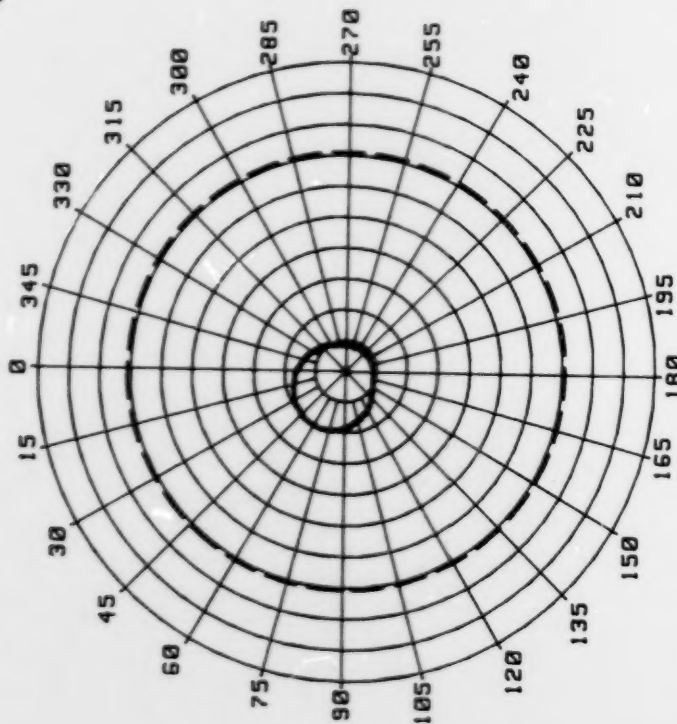
E-PHI

THE FULL-SCALE VALUE IS 1.41 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

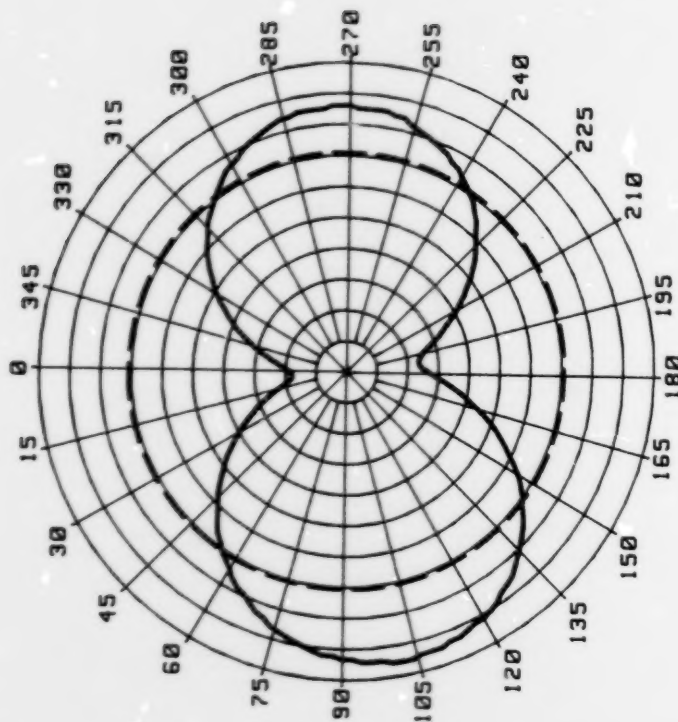
ARC ELECTROMAGNETIC ENGINEERING
8 FEB 1986 13:47:54

COMPILED FROM VOLUME ON FILE SPECIFIC AT
THE ISOTROPIC LEVEL AND -3.00 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 120.00 MHz
CH-135 HELICOPTER 5.00 MHz
YAW PLANE PATTERNS



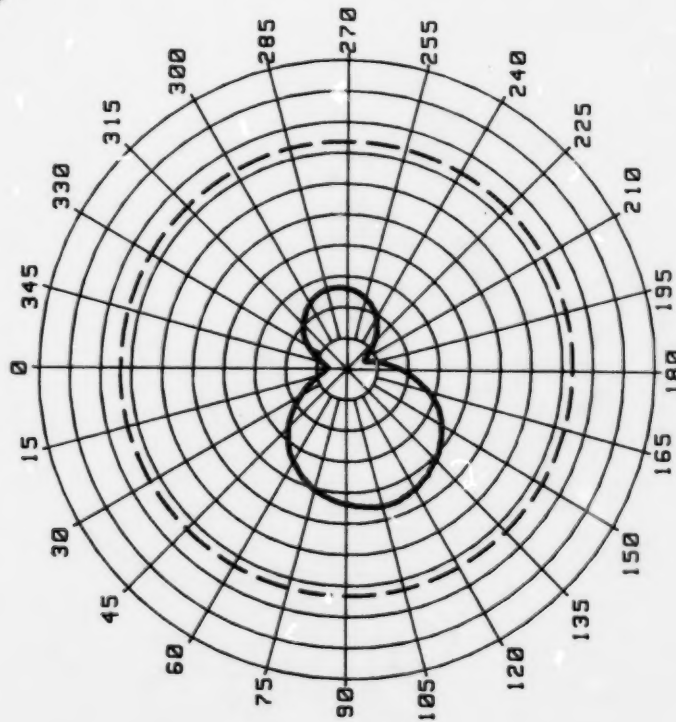
E-THETA



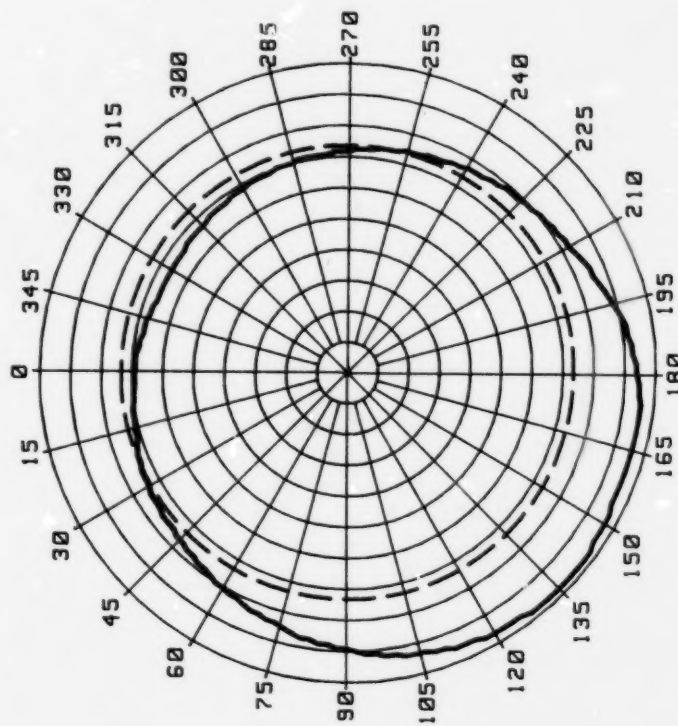
E-PHI

THE FULL-SCALE VALUE IS 1.41 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 168.00 MHz
CH-135 HELICOPTER 7.00 MHz
ROLL PLANE PATTERNS



E-THETA



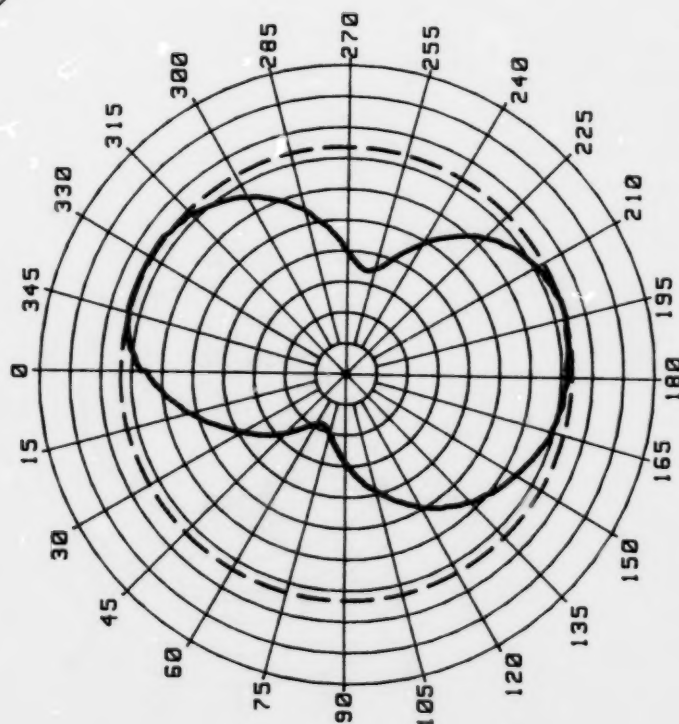
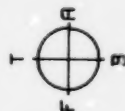
E-PHI

THE FULL-SCALE VALUE IS 1.36 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

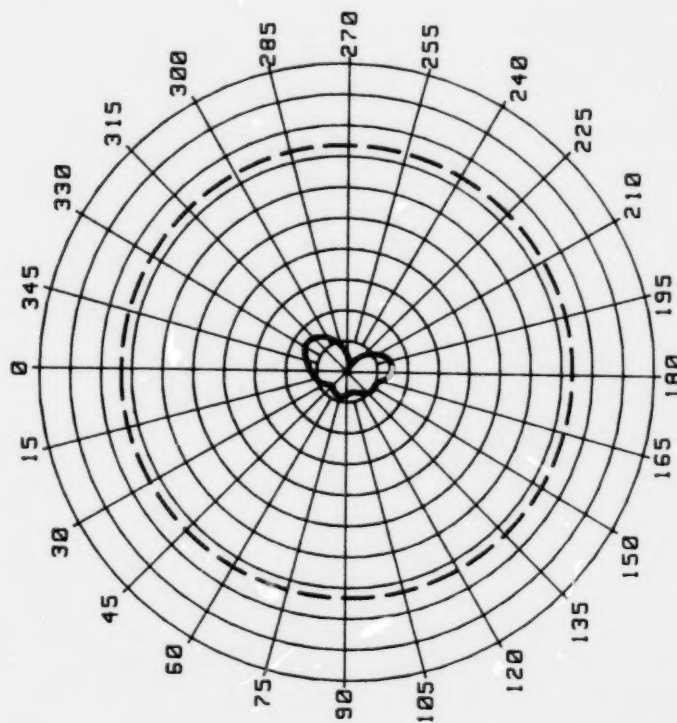
NRC ELECTROMAGNETIC ENGINEERING
8 FEB 1966 15:03:26

COMPILED FROM VOLUME ONE FILE SPECIFIER C3
THE ISOTROPIC LEVEL WAS -3.23 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 168.00 MHz
CH-135 HELICOPTER 7.00 MHz
PITCH PLANE PATTERNS



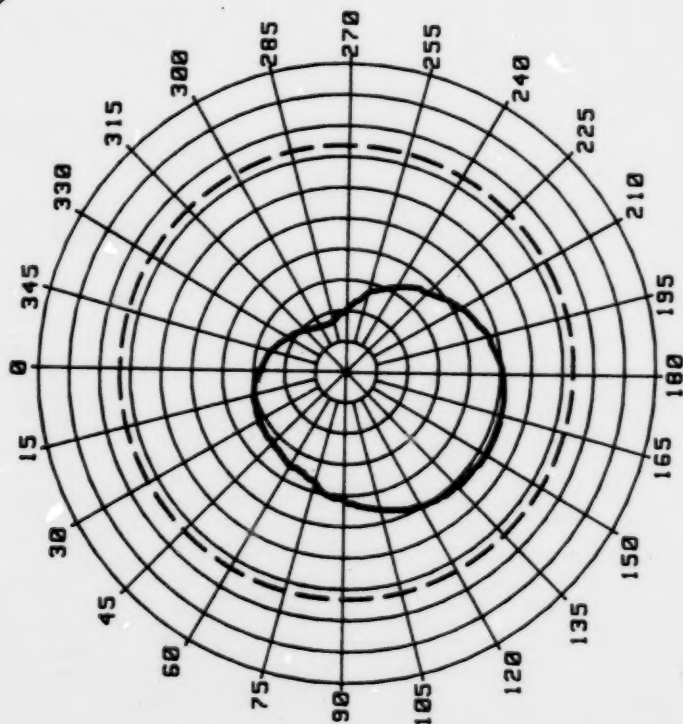
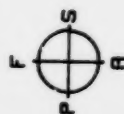
E-THETA



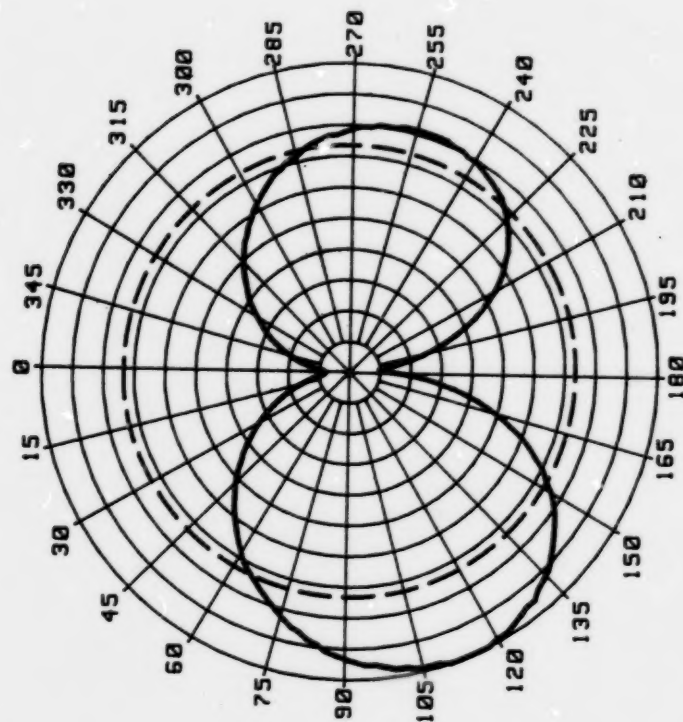
E-PHI

THE FULL-SCALE VALUE IS 1.36 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 168.00 MHz
CH-135 HELICOPTER 7.00 MHz
YAW PLANE PATTERNS



E-THETA



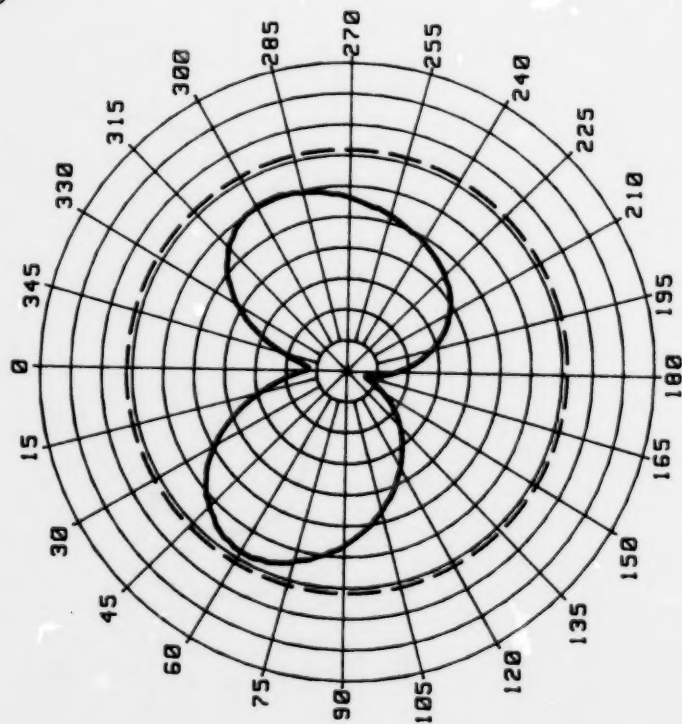
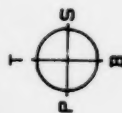
E-PHI

THE FULL-SCALE VALUE IS 1.36 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

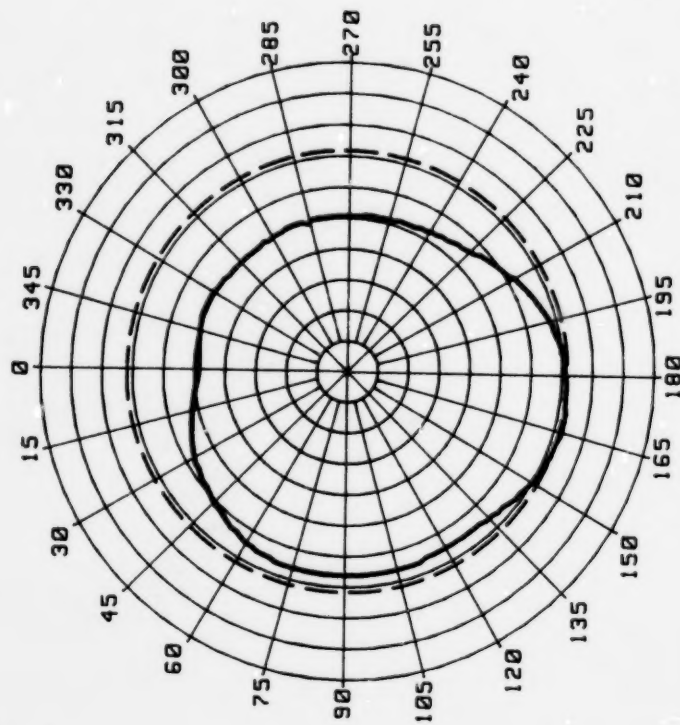
NRC ELECTROMAGNETIC ENGINEERING
8 FEB 1986 14103141

COMPILED FROM VOLUME ONE FILE SPECIFIER 1
THE ISOTROPIC LEVEL WAS -8.59 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 216.00 MHz
CH-135 HELICOPTER 9.00 MHz
ROLL PLANE PATTERNS



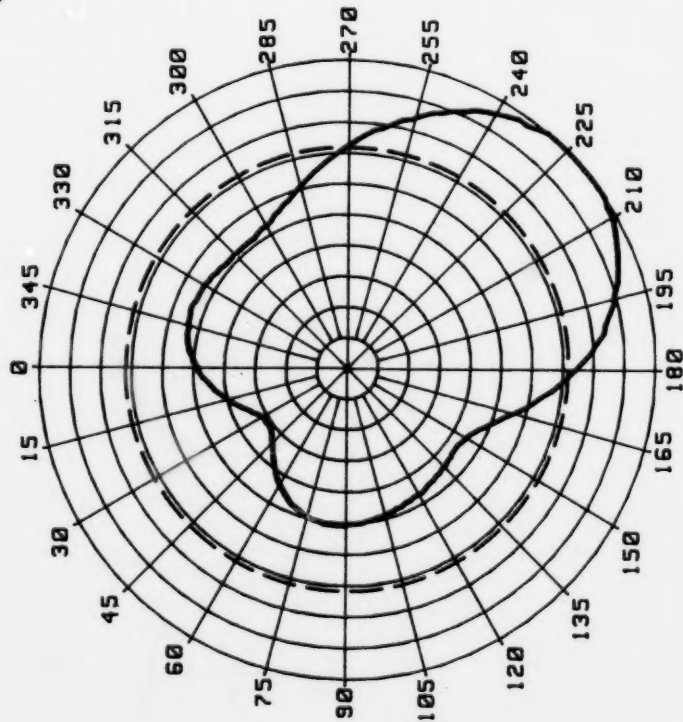
E-THETA



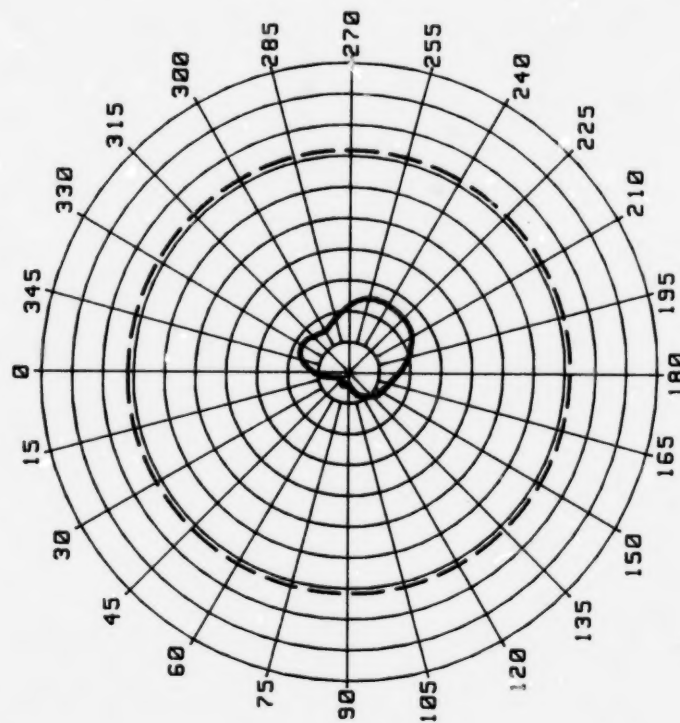
E-PHI

THE FULL-SCALE VALUE IS 1.39 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 216.00 MHz
 CH-135 HELICOPTER 9.00 MHz
 PITCH PLANE PATTERNS



E-THETA



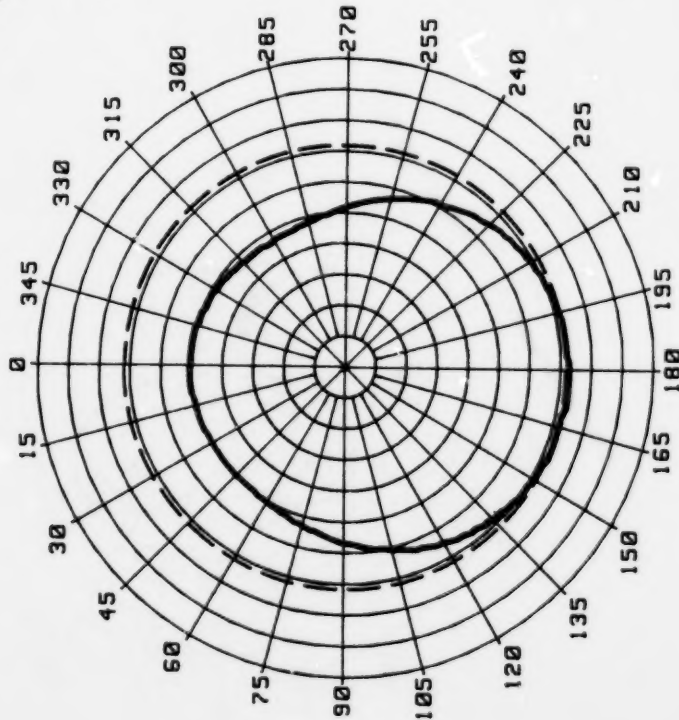
E-PHI

THE FULL-SCALE VALUE IS 1.39 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

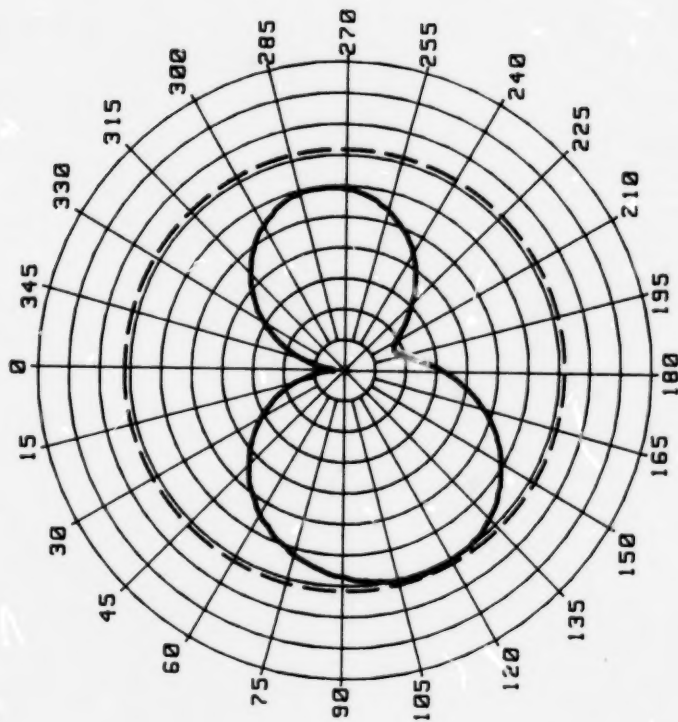
NRC ELECTROMAGNETIC ENGINEERING
 6 FEB 1986 13:57:37

COMPILED FROM VOLUME ONE FILE SPECIFICATION 1
 THE ISOTROPIC LEVEL MRS -8.59 dB
 ROTOR P/S

CH-135 MODEL HELICOPTER 216.00 MHz
 CH-135 HELICOPTER 9.00 MHz
 YAW PLANE PATTERNS



E-THETA

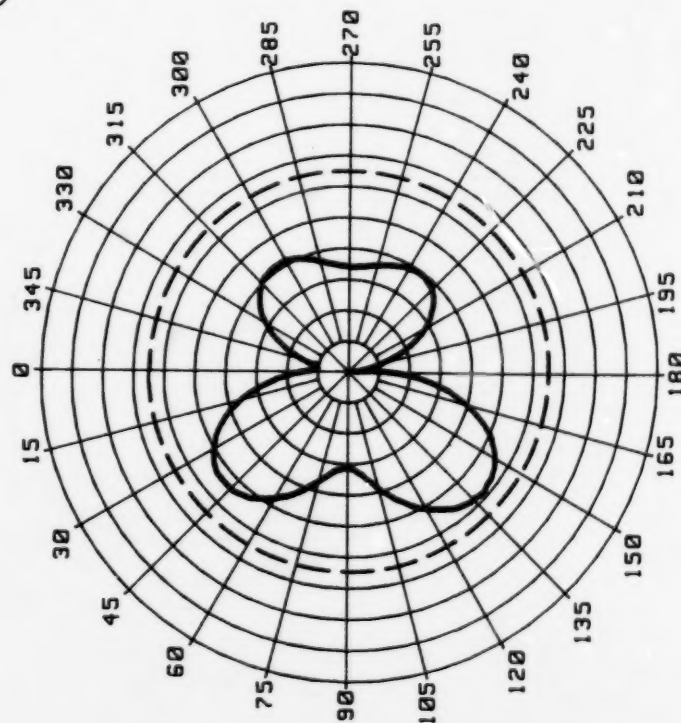


E-PHI

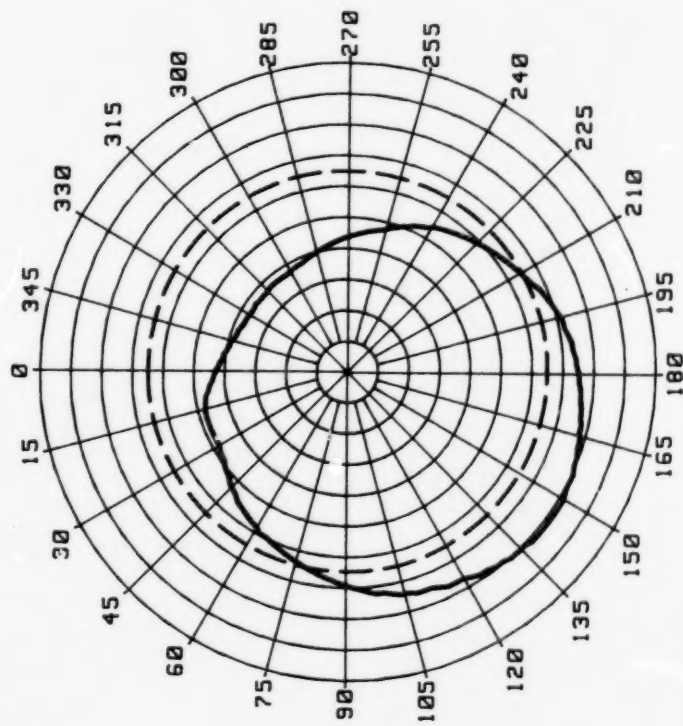
THE FULL-SCALE VALUE IS 1.39 [ISOTROPIC]
 ---- ESTIMATED ISOTROPIC LEVEL

COMPILED FROM VOLUME CH7 FILE SPECIFIER H
THE ISOTROPIC LEVEL WAS -8.87 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 264.00 MHz
CH-135 HELICOPTER 11.00 MHz
ROLL PLANE PATTERNS



E-THETA



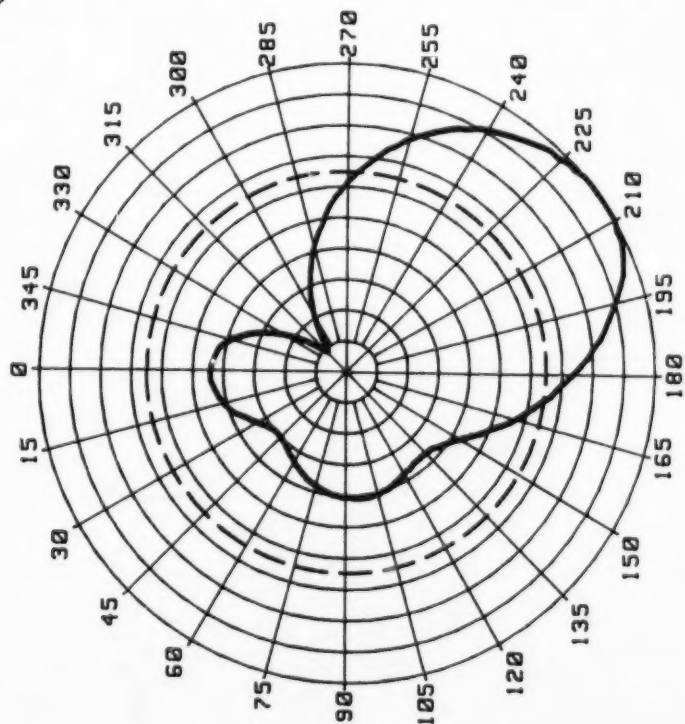
E-PHI

THE FULL-SCALE VALUE IS 1.54 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

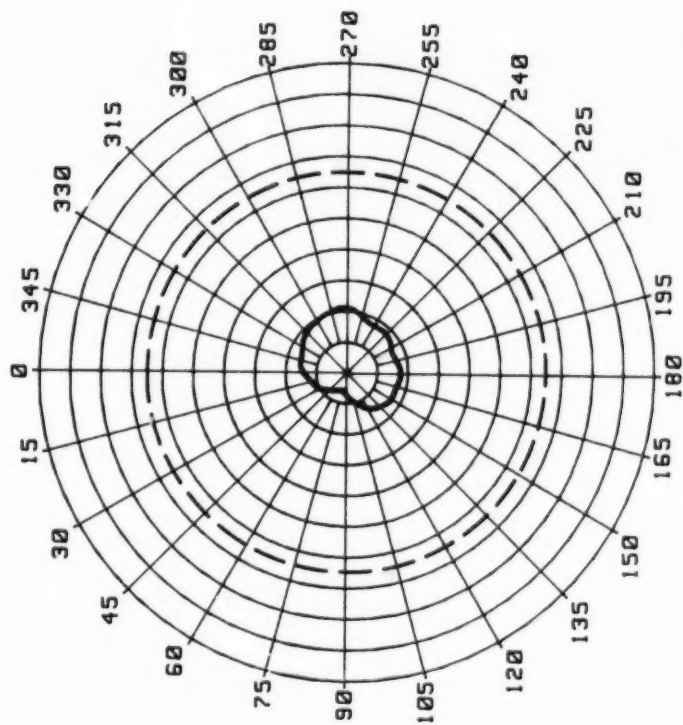
NRC ELECTROMAGNETIC ENGINEERING
6 FEB 1962 13:58:00

COMPILED FROM VOLUME GMP FILE SPECIFIER H
THE ISOTROPIC LEVEL WAS -8.87 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 264.00 MHz
CH-135 HELICOPTER 11.00 MHz
PITCH PLANE PATTERNS



E-THETA

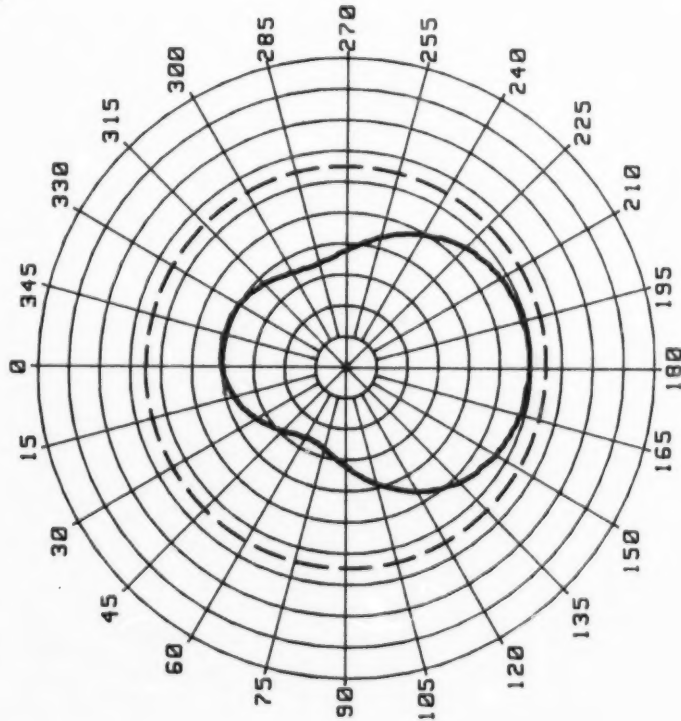
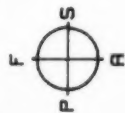


E-PHI

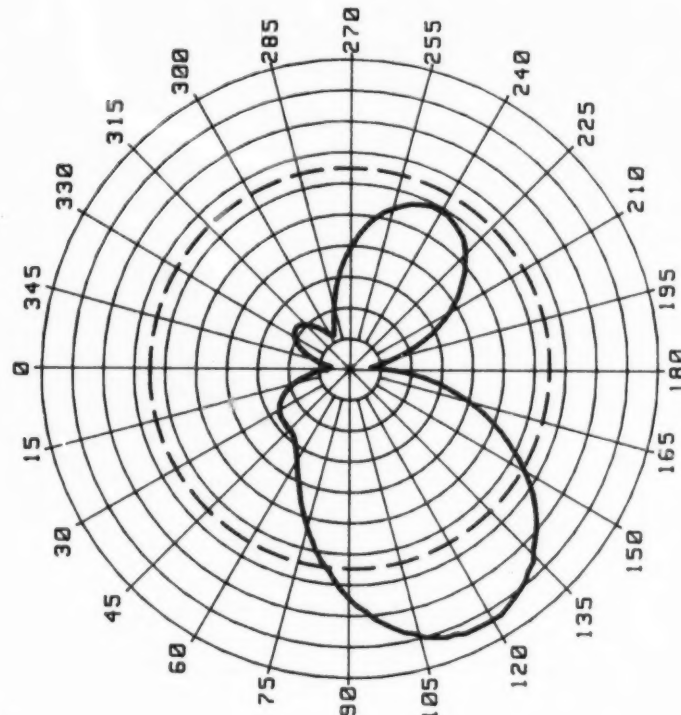
THE FULL-SCALE VALUE IS 1.54 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

COMPILED FROM VOLUME CAP FILE SPECIFIER H
THE ISOTROPIC LEVEL WAS -8.87 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 264.00 MHz
CH-135 HELICOPTER 11.00 MHz
YAW PLANE PATTERNS



E-THETA



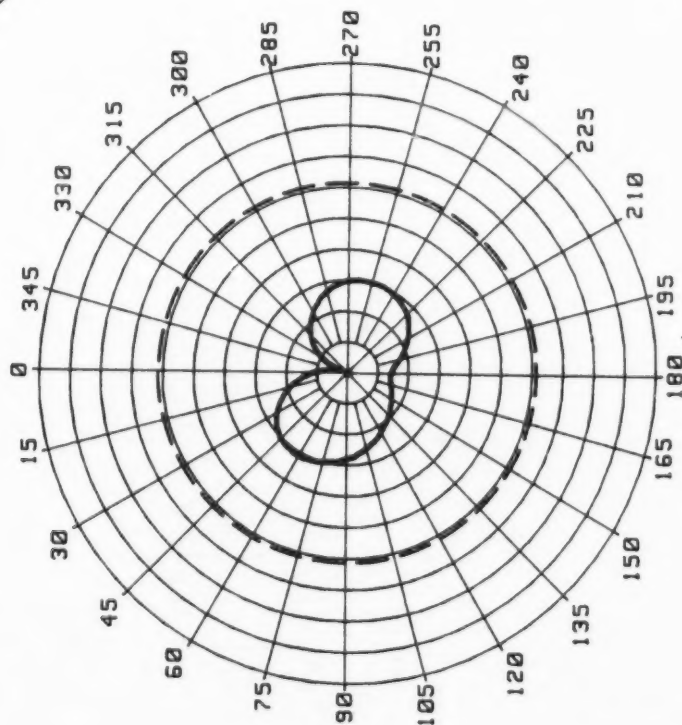
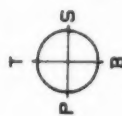
E-PHI

THE FULL-SCALE VALUE IS 1.54 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

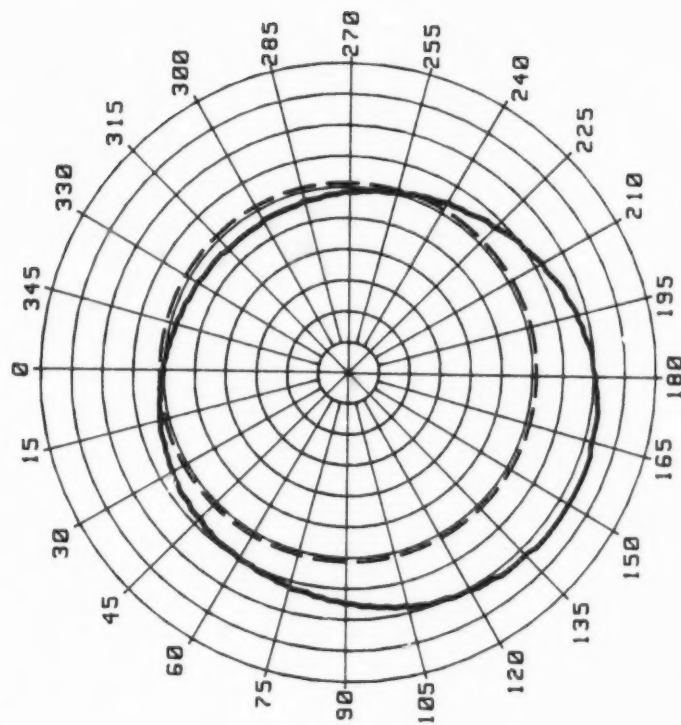
NMC ELECTROMAGNETIC ENGINEERING
6 FEB 1986 13:28:38

COMPILED FROM VOLUME ONE FILE SPECIFIER 01
THE ISOTROPIC LEVEL WAS -7.45 dB
MOTOR P/S

CH-135 MODEL HELICOPTER 312.00 MHz
CH-135 HELICOPTER 13.00 MHz
ROLL PLANE PATTERNS



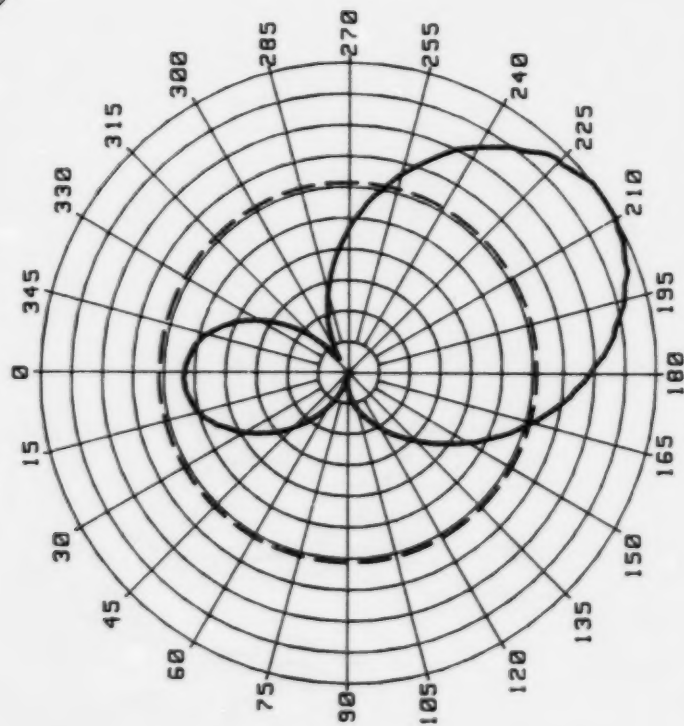
E-THETA



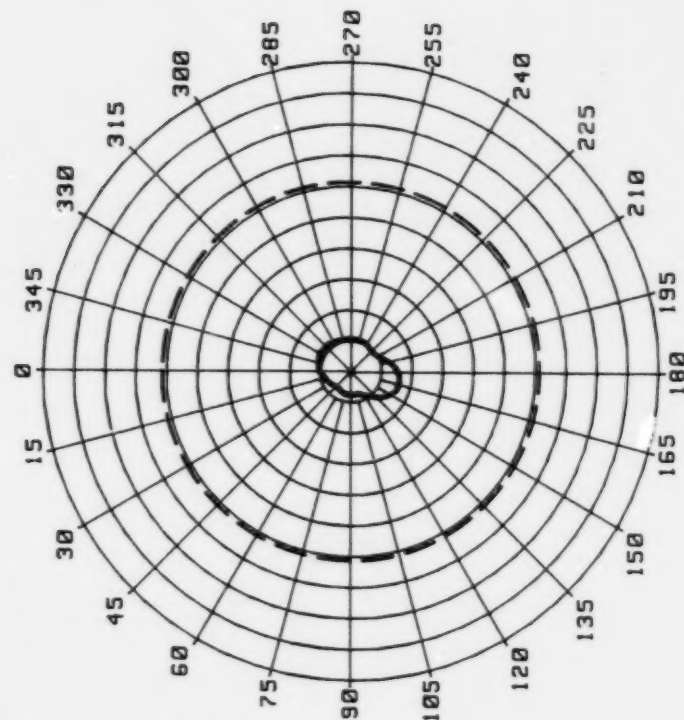
E-PHI

THE FULL-SCALE VALUE IS 1.63 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 312.00 MHz
 CH-135 HELICOPTER 13.00 MHz
 PITCH PLANE PATTERNS



E-THETA



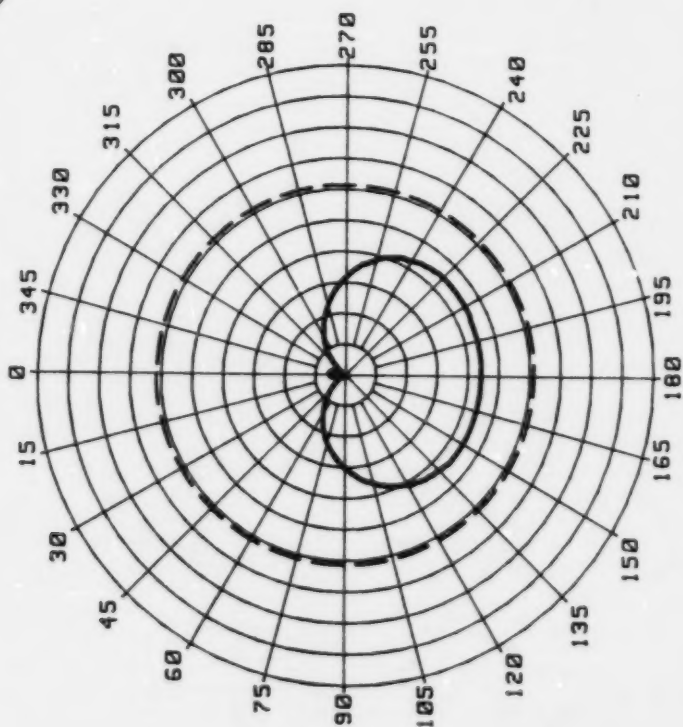
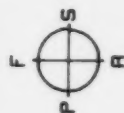
E-PHI

THE FULL-SCALE VALUE IS 1.63 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

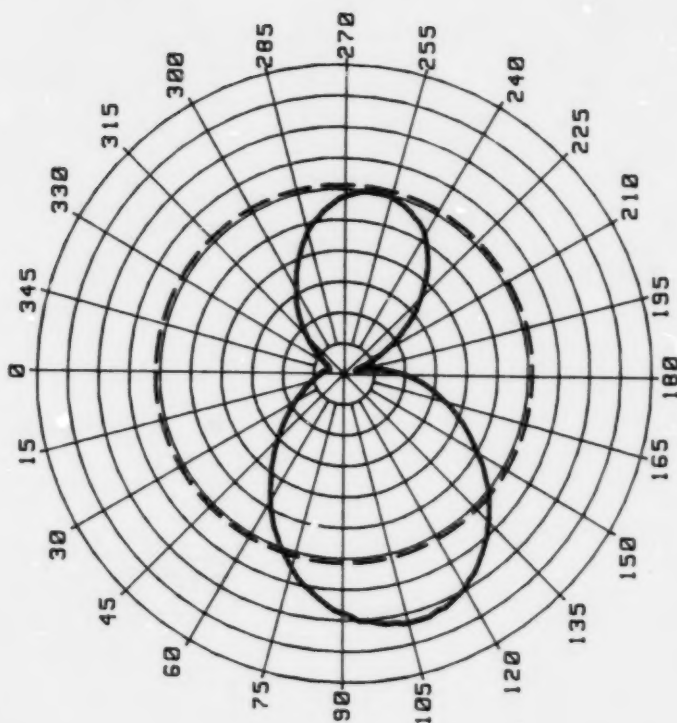
NRC ELECTROMAGNETIC ENGINEERING
6 FEB 1986 13:14:32

COMPILED FROM VOLUME ONE FILE SPECIFIC 01
THE ISOTROPIC LEVEL WAS -7.95 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 312.00 MHz
CH-135 HELICOPTER 13.00 MHz
YAW PLANE PATTERNS



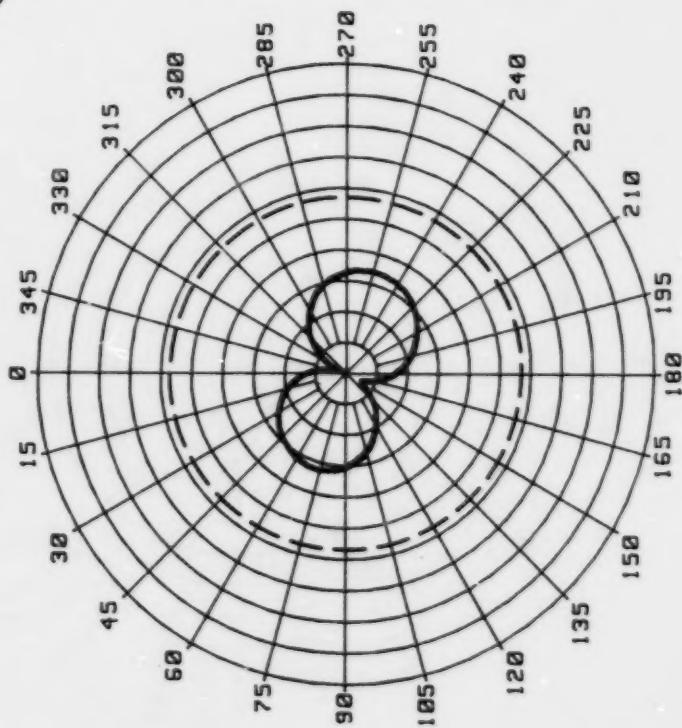
E-THETA



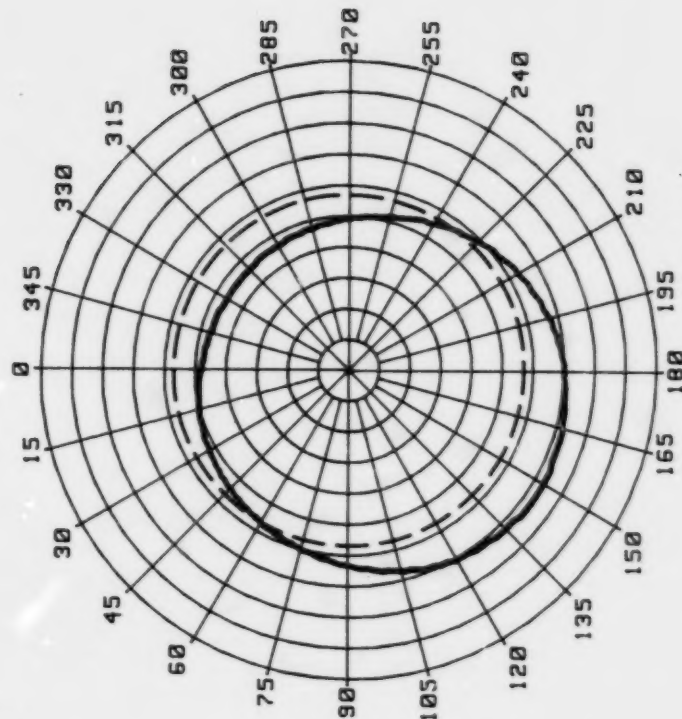
E-PHI

THE FULL-SCALE VALUE IS 1.63 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 360.00 MHz
CH-135 HELICOPTER 15.00 MHz
ROLL PLANE PATTERNS



E-THETA



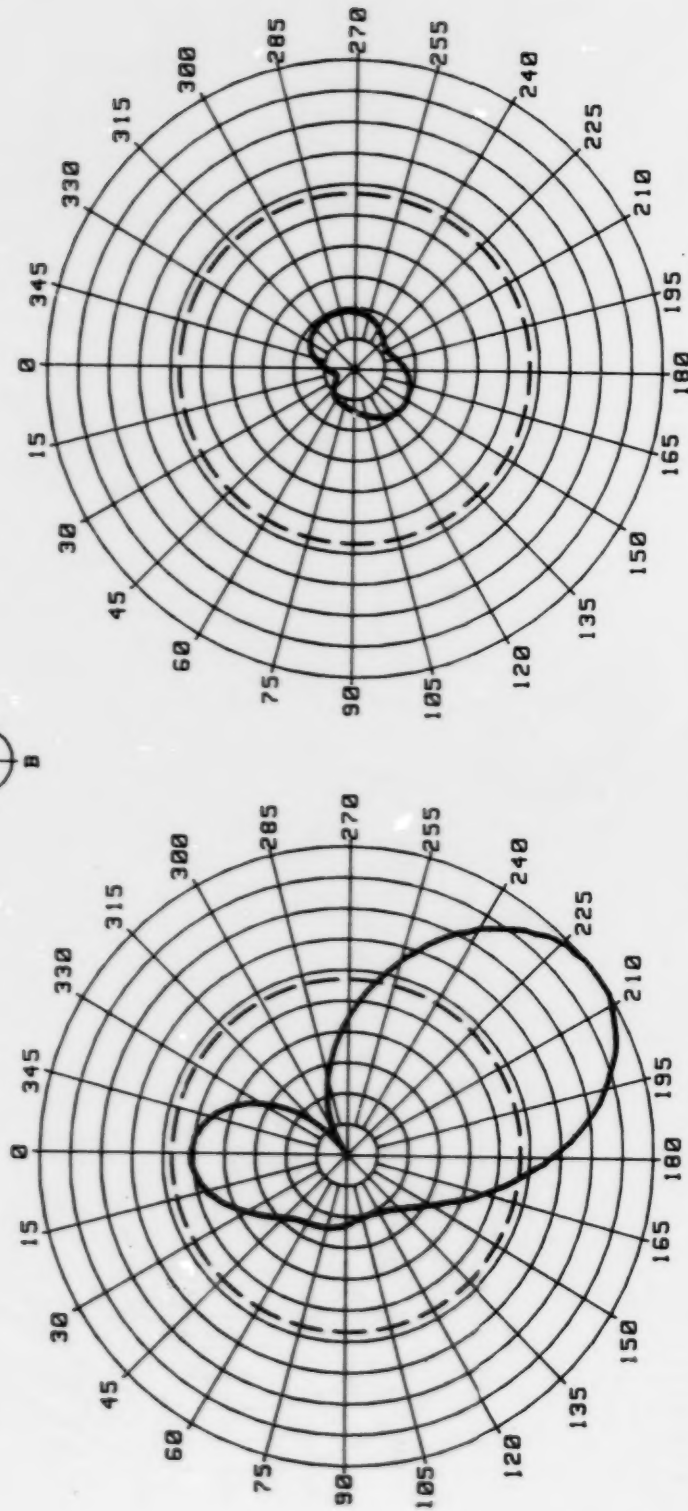
E-PHI

THE FULL-SCALE VALUE IS 1.76 (ISOTROPIC)
--- ESTIMATED ISOTROPIC LEVEL

NRC ELECTROMAGNETIC ENGINEERING
8 FEB 1986 13:07:57

COMPILED FROM VOLUME ONE FILE SPECIFIER U
THE ISOTROPIC LEVEL WAS -6.00 dB
MOTOR P/S

CH-135 MODEL HELICOPTER 360.00 MHz
CH-135 HELICOPTER 15.00 MHz
PITCH PLANE PATTERNS

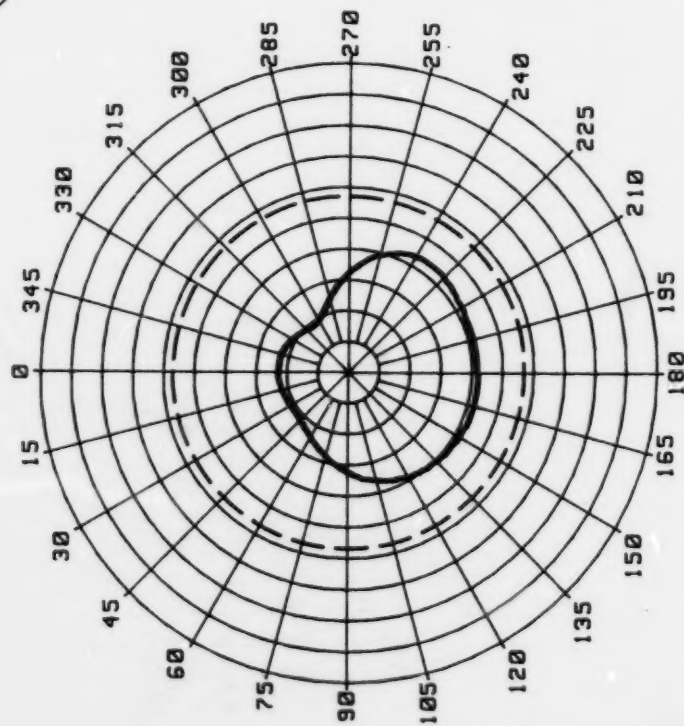
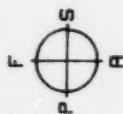


E-THETA

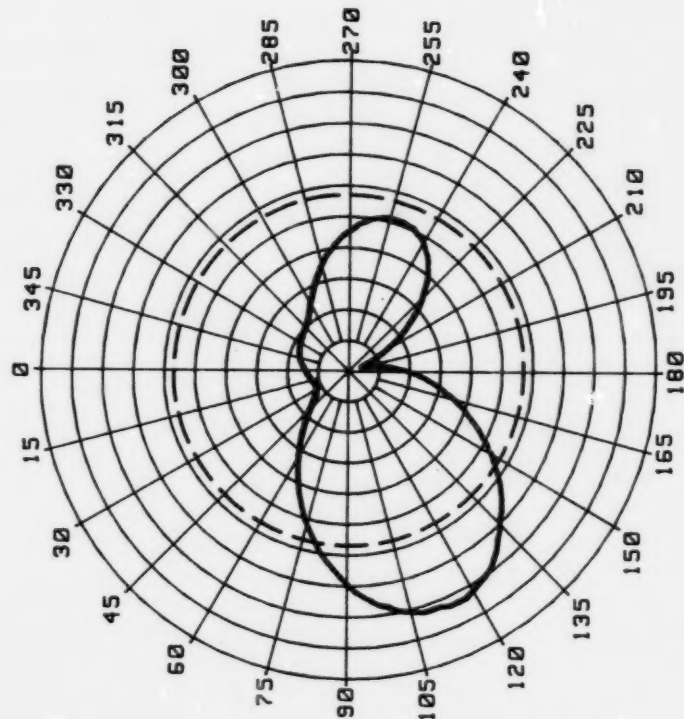
E-PHI

THE FULL-SCALE VALUE IS 1.76 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 360.00 MHz
CH-135 HELICOPTER 15.00 MHz
YAW PLANE PATTERNS



E-THETA



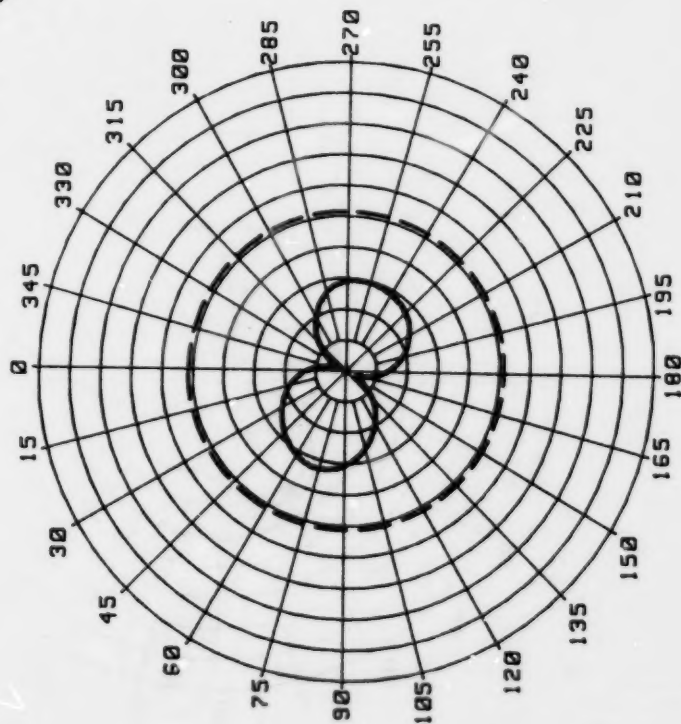
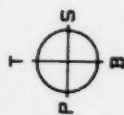
E-PHI

THE FULL-SCALE VALUE IS 1.76 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

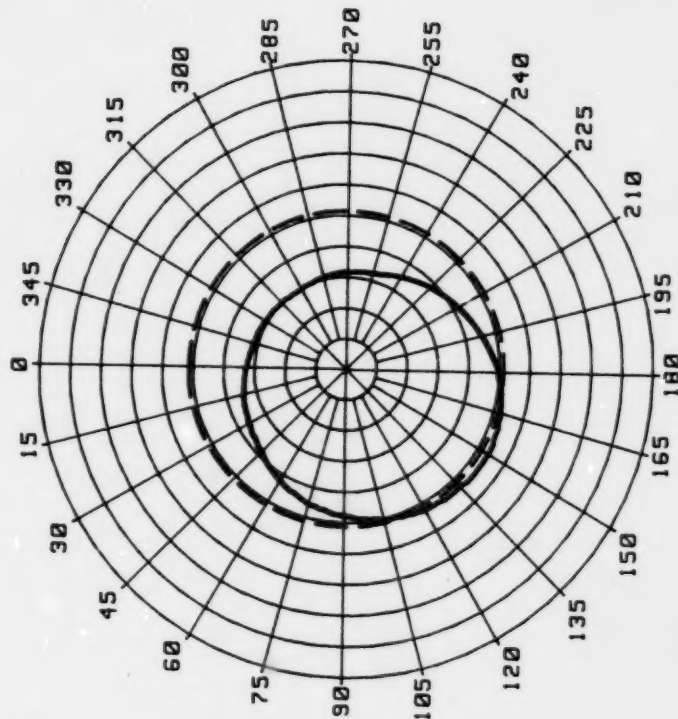
NRC ELECTROMAGNETIC ENGINEERING
8 FEB 1986 12:43:31

COMPILED FROM VOLUME CH-135 FILE SPECIFIER Y2
THE ISOTROPIC LEVEL WAS -6.23 dB
MOTOR P/S

CH-135 MODEL HELICOPTER 408.00 MHz
CH-135 HELICOPTER 17.00 MHz
ROLL PLANE PATTERNS



E-THETA



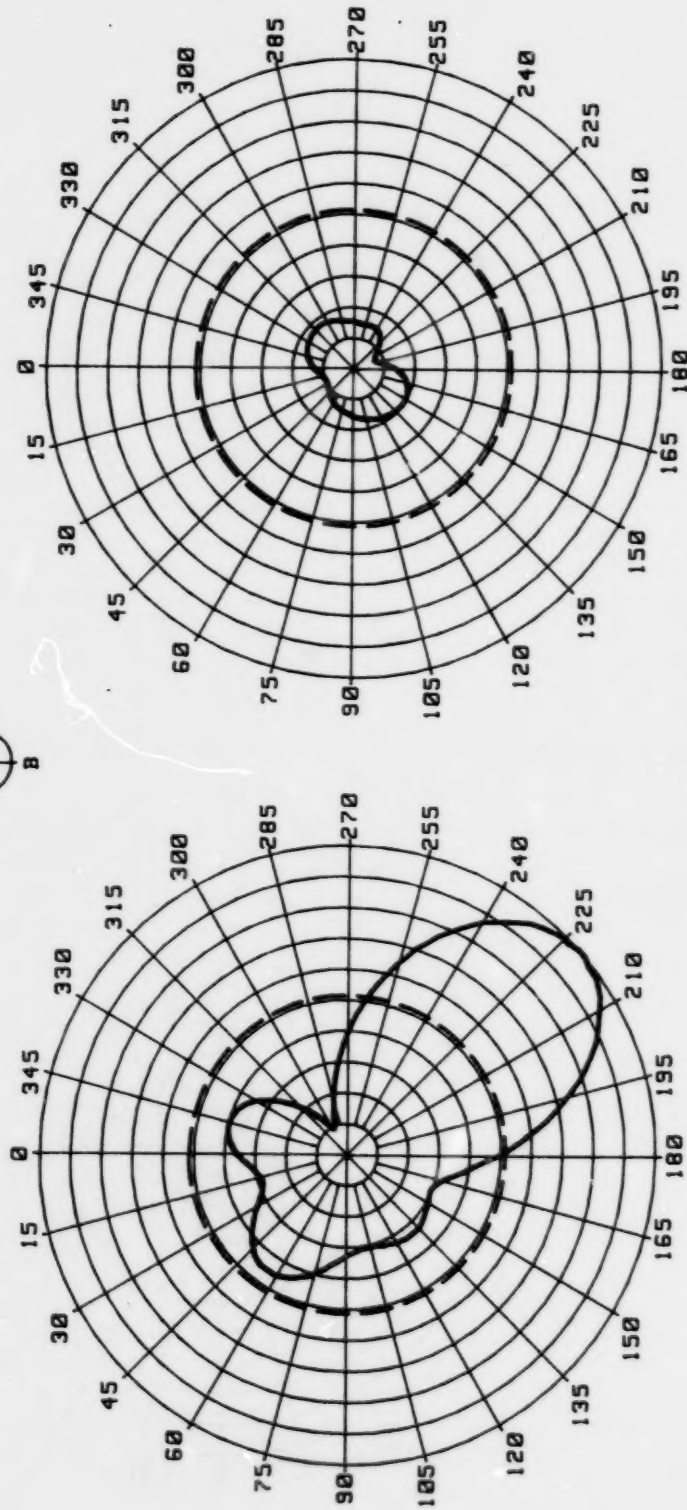
E-PHI

THE FULL-SCALE VALUE IS 1.95 (ISOTROPIC)
---- ESTIMATED ISOTROPIC LEVEL

NRC ELECTROMAGNETIC ENGINEERING
8 FEB 1986 12:48:17

COMPILED FROM VOLUME CHB FILE SPECIFIER Y2
THE ISOTROPIC LEVEL WRE -6.25 dB
MOTOR P/S

CH-135 MODEL HELICOPTER 408.00 MHz
CH-135 HELICOPTER 17.00 MHz
PITCH PLANE PATTERNS



E-THETA

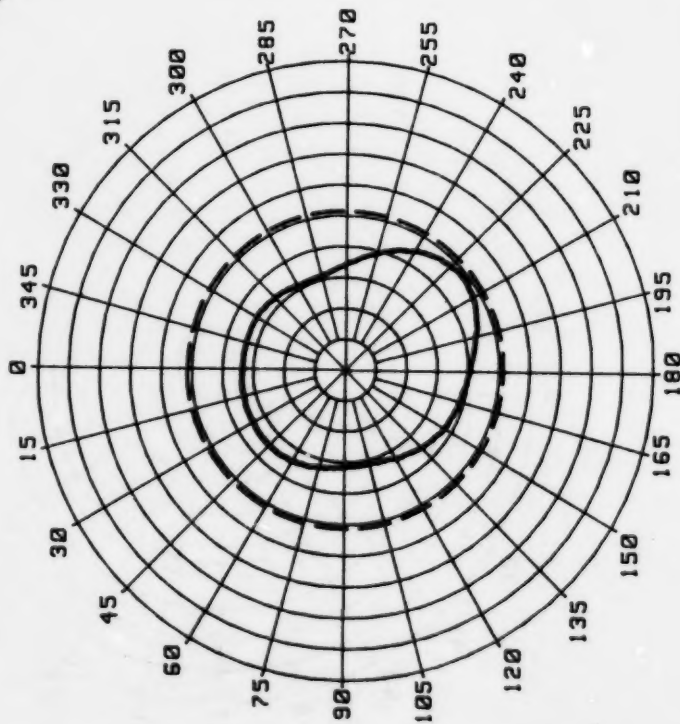
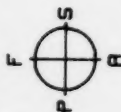
E-PHI

THE FULL-SCALE VALUE IS 1.95 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

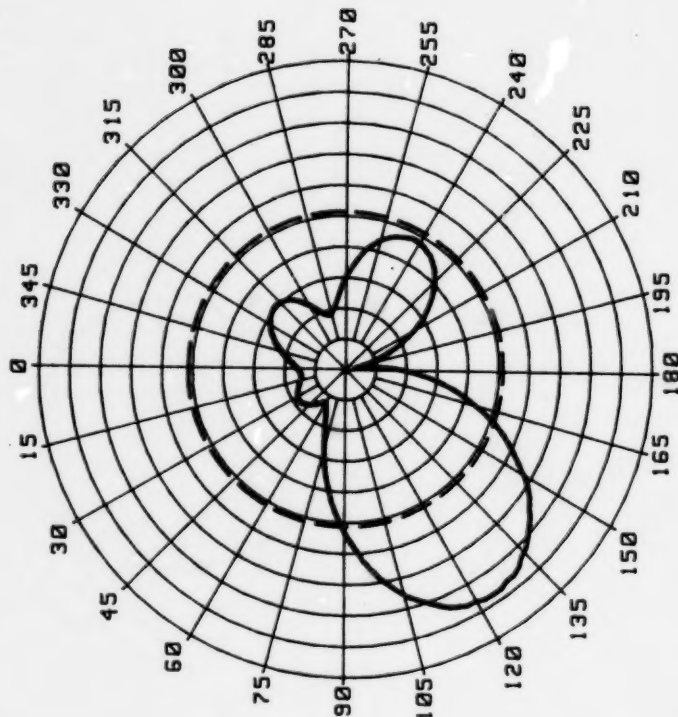
EMC ELECTROMAGNETIC ENGINEERING
 6 FEB 1966 12:18:58

COMPILED FROM VOLUME ONE FILE SPECIFIER YE
 THE ISOTROPIC LEVEL HAS -8.23 dB
 ROTOR P/S

CH-135 MODEL HELICOPTER 408.00 MHz
 CH-135 HELICOPTER 17.00 MHz
 YAW PLANE PATTERNS



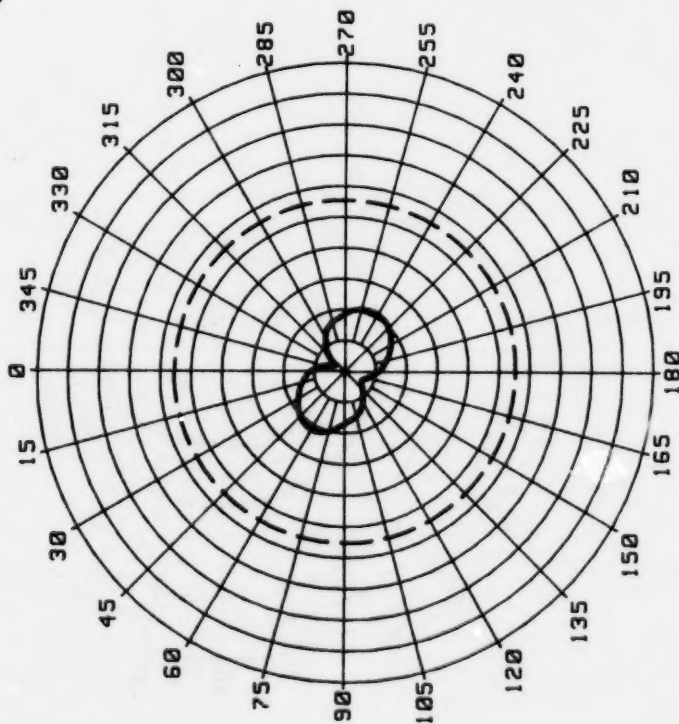
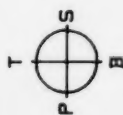
E-THETA



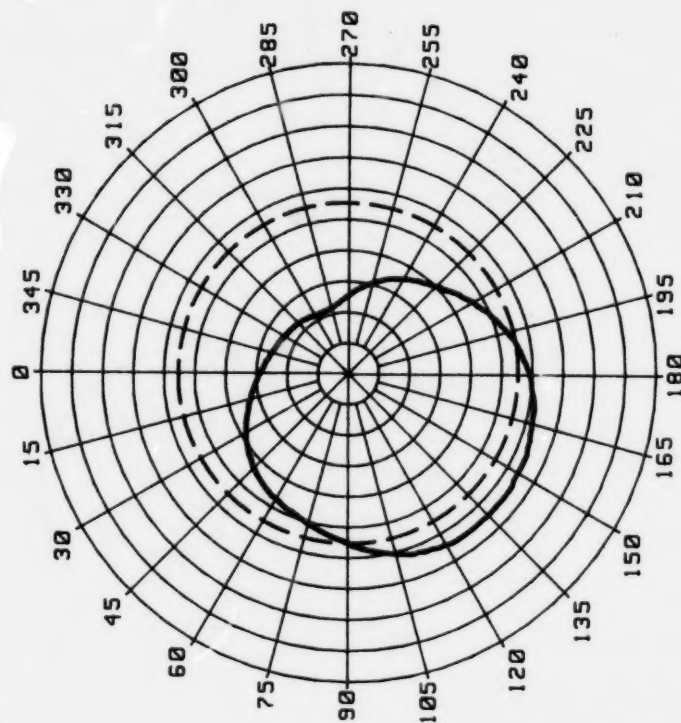
E-PHI

THE FULL-SCALE VALUE IS 1.95 [ISOTROPIC]
 ---- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 456.00 MHz
 CH-135 HELICOPTER 19.00 MHz
 ROLL PLANE PATTERNS



E-THETA



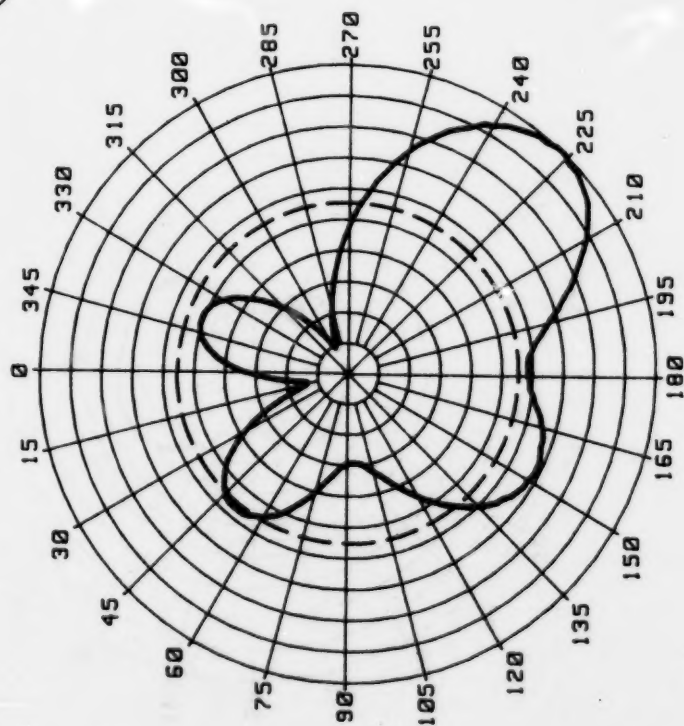
E-PHI

THE FULL-SCALE VALUE IS 1.81 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

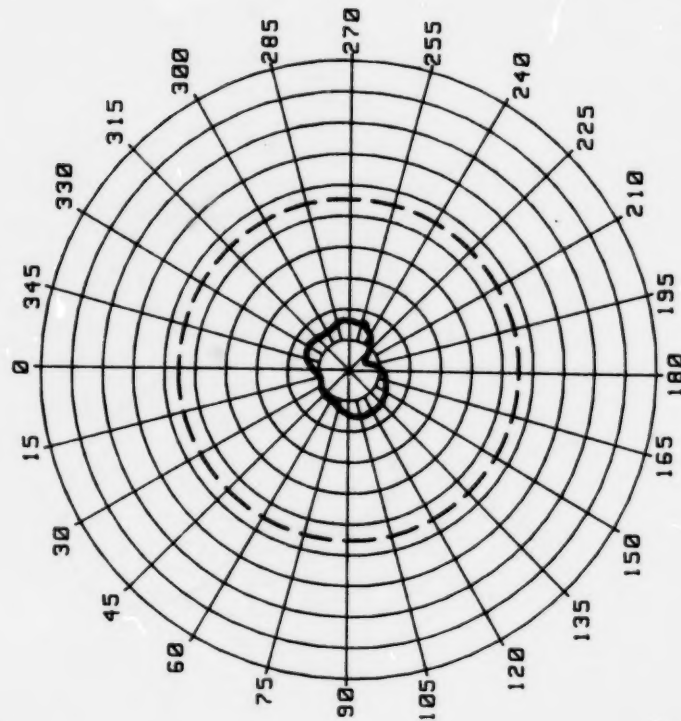
NMC ELECTROMAGNETIC ENGINEERING
6 FEB 1966 12:18:31

COMPILED FROM VOLUME CH8 FILE SPECIFIER 0
THE ISOTROPIC LEVEL WAS -5.45 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 456.00 MHz
CH-135 HELICOPTER 19.00 MHz
PITCH PLANE PATTERNS



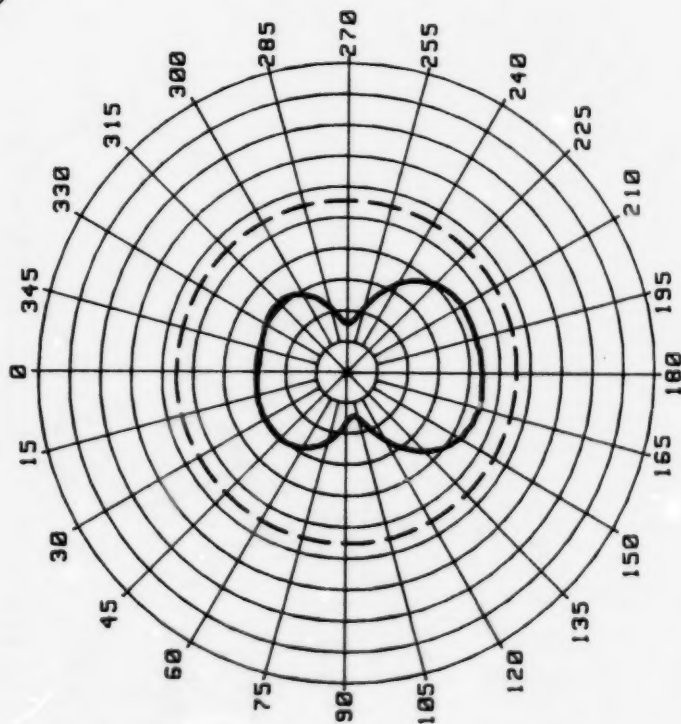
E-THETA



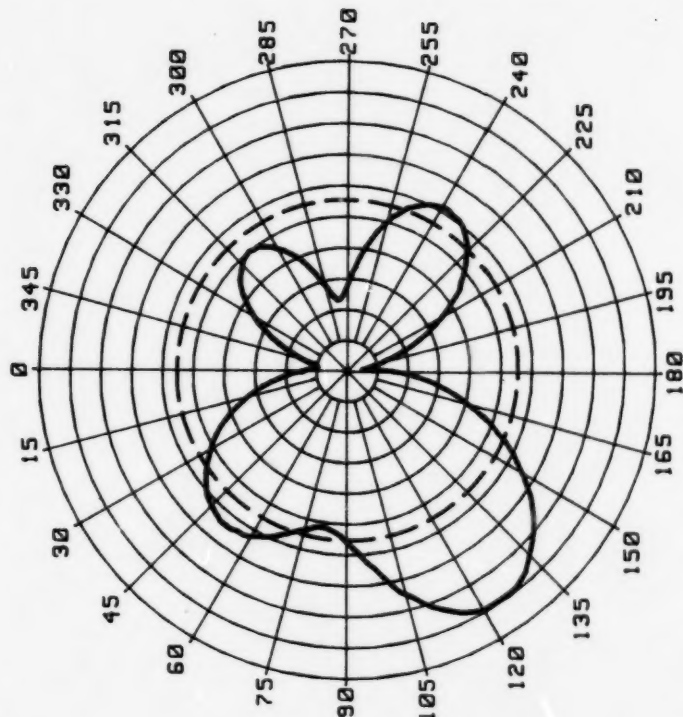
E-PHI

THE FULL-SCALE VALUE IS 1.81 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 456.00 MHz
CH-135 HELICOPTER 19.00 MHz
YAW PLANE PATTERNS



E-THETA



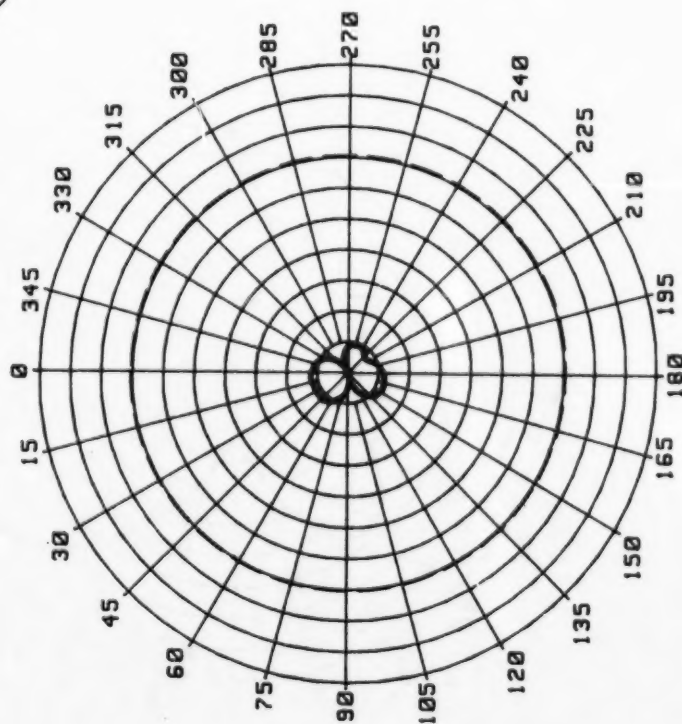
E-PHI

THE FULL-SCALE VALUE IS 1.81 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

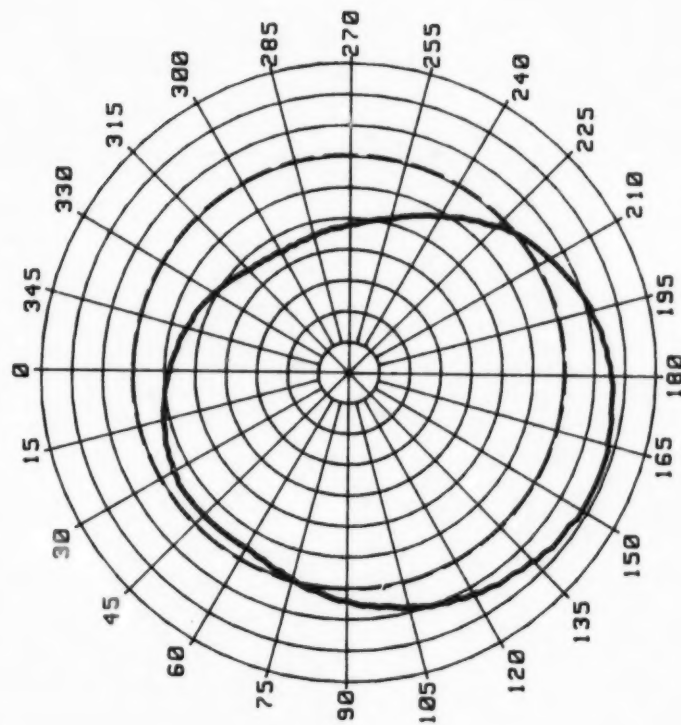
NRC ELECTROMAGNETIC ENGINEERING
 6 FEB 1986 11:39:56

COMPILED FROM VOLUME ONE FILE SPECIFIER B
 THE ISOTROPIC LEVEL HAS -8.37 dB
 ROTOR P/S

CH-135 MODEL HELICOPTER 504.00 MHz
 CH-135 HELICOPTER 21.00 MHz
 ROLL PLANE PATTERNS



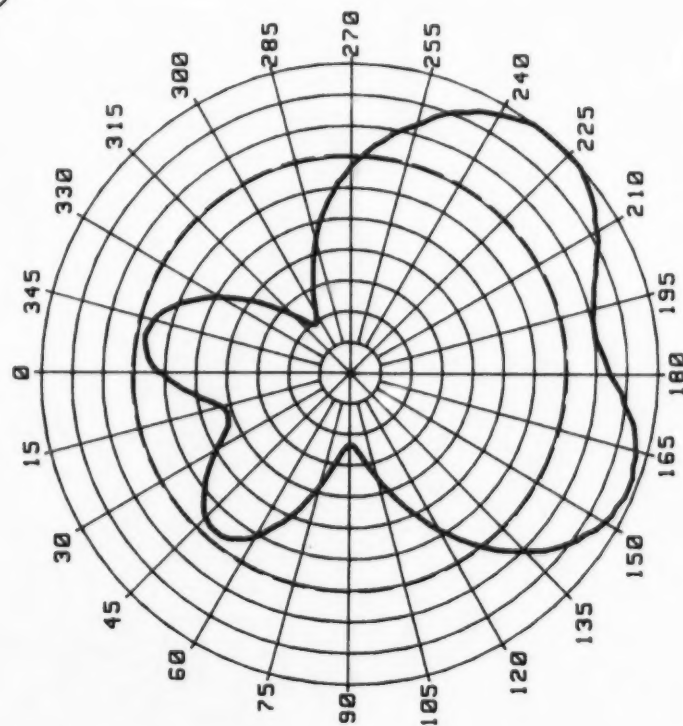
E-THETA



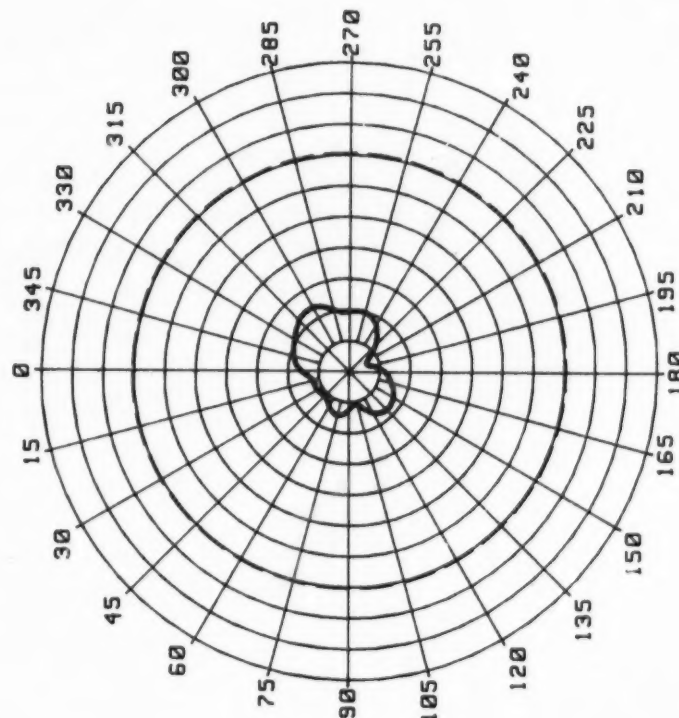
E-PHI

THE FULL-SCALE VALUE IS 1.42 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 504.00 MHz
CH-135 HELICOPTER 21.00 MHz
PITCH PLANE PATTERNS



E-THETA



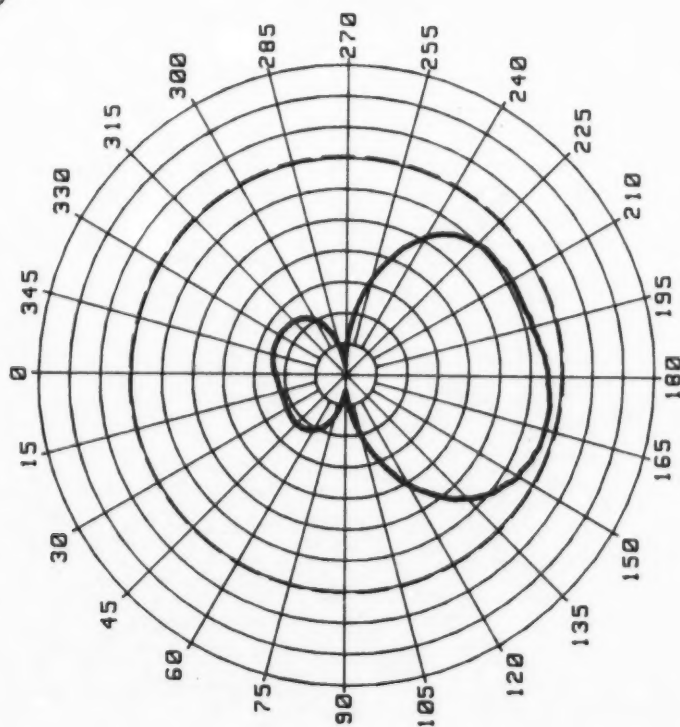
E-PHI

THE FULL-SCALE VALUE IS 1.42 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

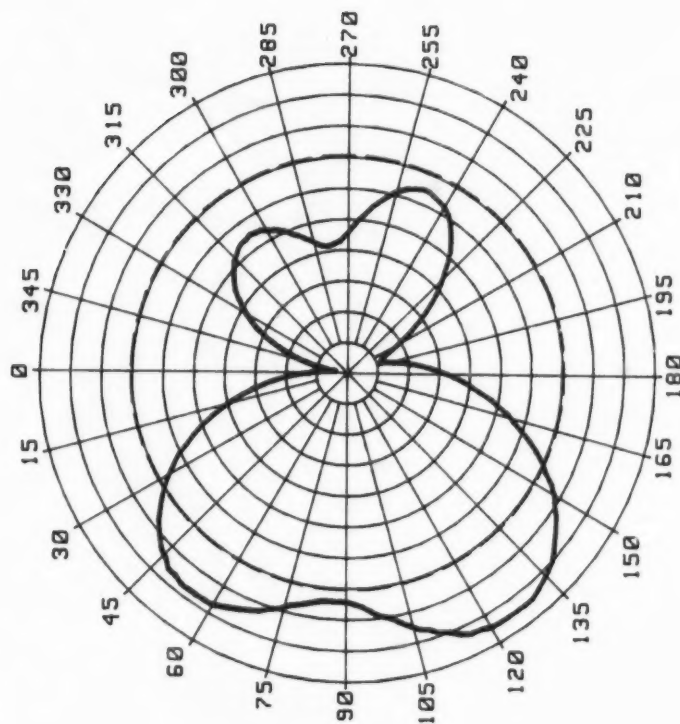
NBC ELECTROMAGNETIC ENGINEERING
6 FEB 1966 11:33:54

COMPILED FROM VOLUME ONE FILE SPECIFIER 8
THE ISOTROPIC LEVEL WAS -8.37 dB
ROTOR P/E

CH-135 MODEL HELICOPTER 504.00 MHz
CH-135 HELICOPTER 21.00 MHz
YAW PLANE PATTERNS



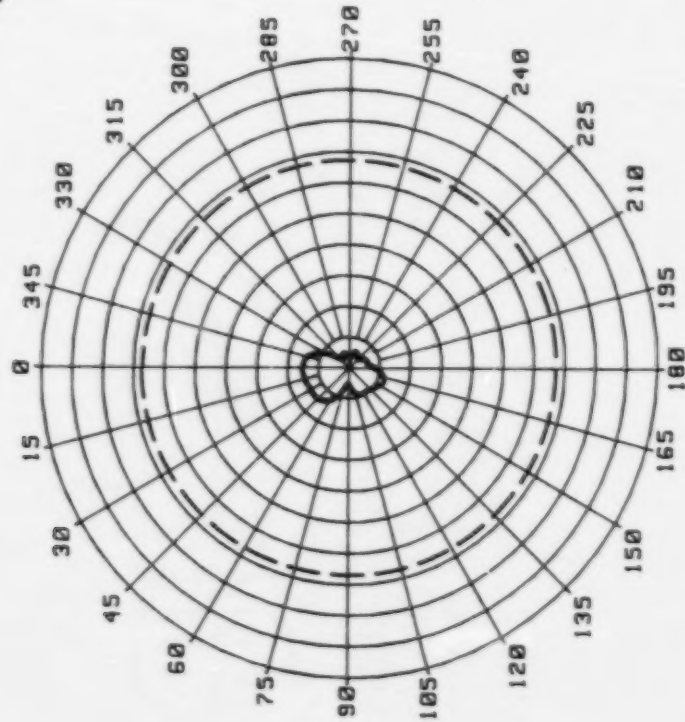
E-THETA



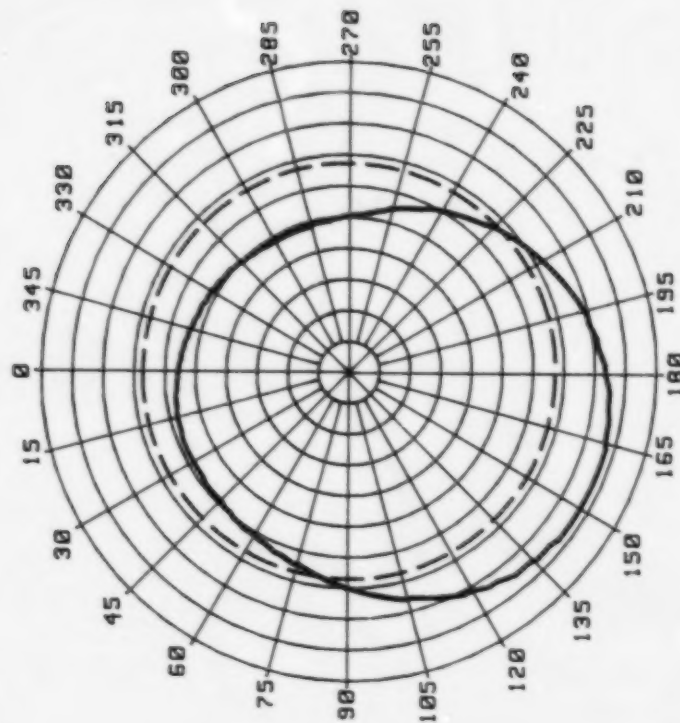
E-PHI

THE FULL-SCALE VALUE IS 1.42 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 552.00 MHz
CH-135 HELICOPTER 23.00 MHz
ROLL PLANE PATTERNS



E-THETA



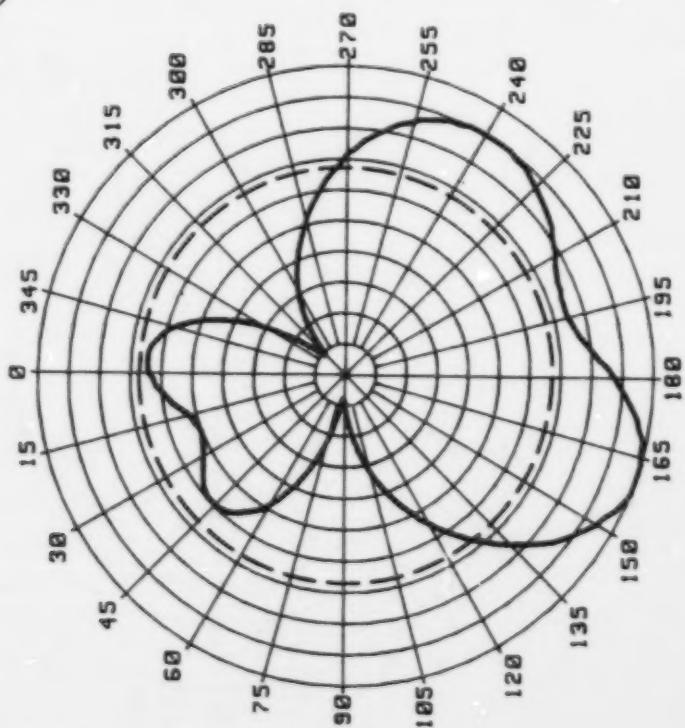
E-PHI

THE FULL-SCALE VALUE IS 1.49 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

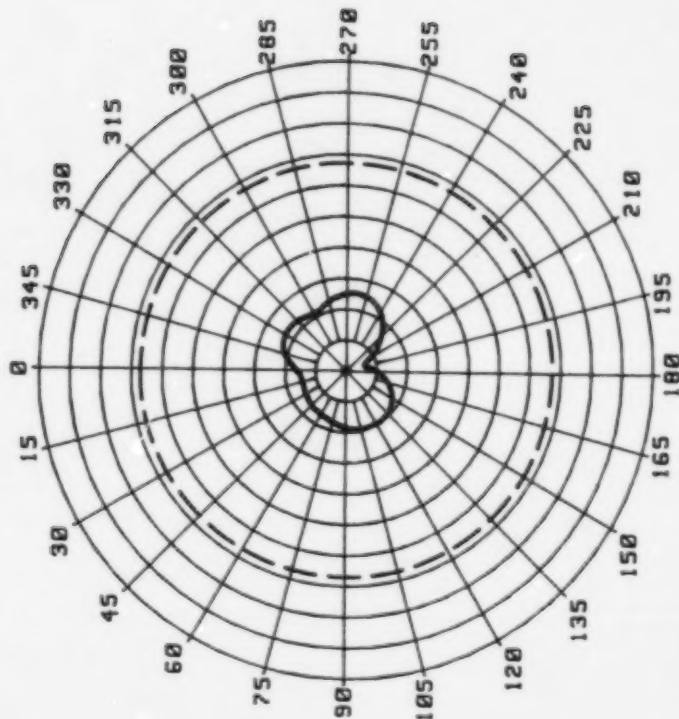
NSC ELECTROMAGNETIC ENGINEERING
6 FEB 1966 11:25:14

COMPILED FROM VOLUME CMB FILE SPECIFIED A
THE ISOTROPIC LEVEL WAS -1.47 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 552.00 MHz
CH-135 HELICOPTER 23.00 MHz
PITCH PLANE PATTERNS



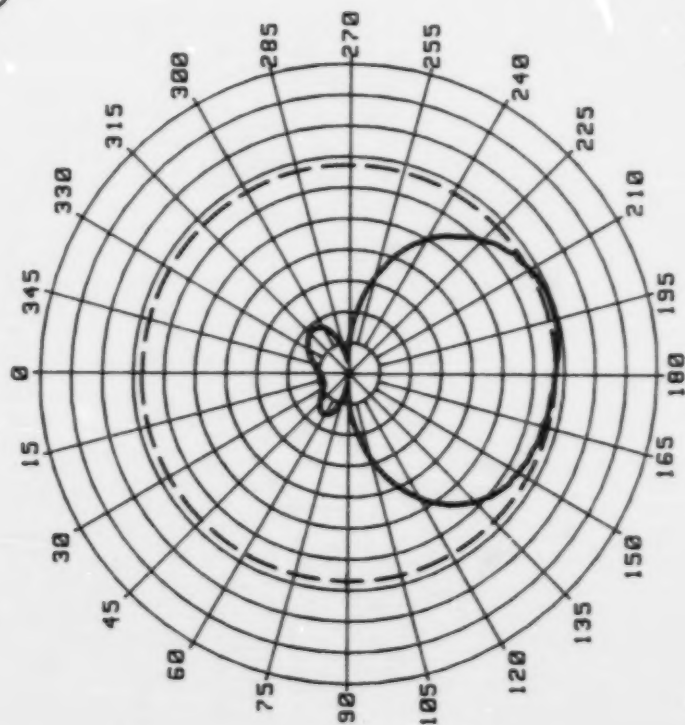
E-THETA



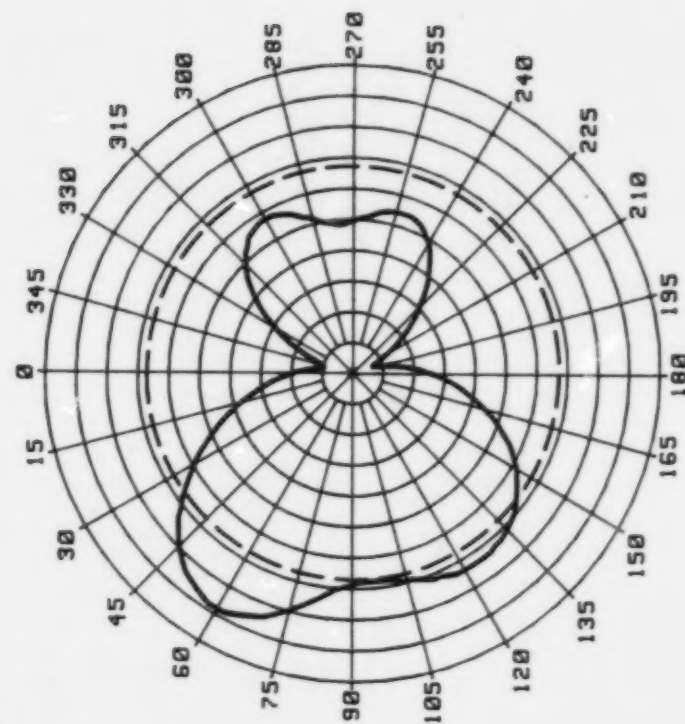
E-PHI

THE FULL-SCALE VALUE IS 1.49 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 552.00 MHz
CH-135 HELICOPTER 23.00 MHz
YAW PLANE PATTERNS



E-THETA



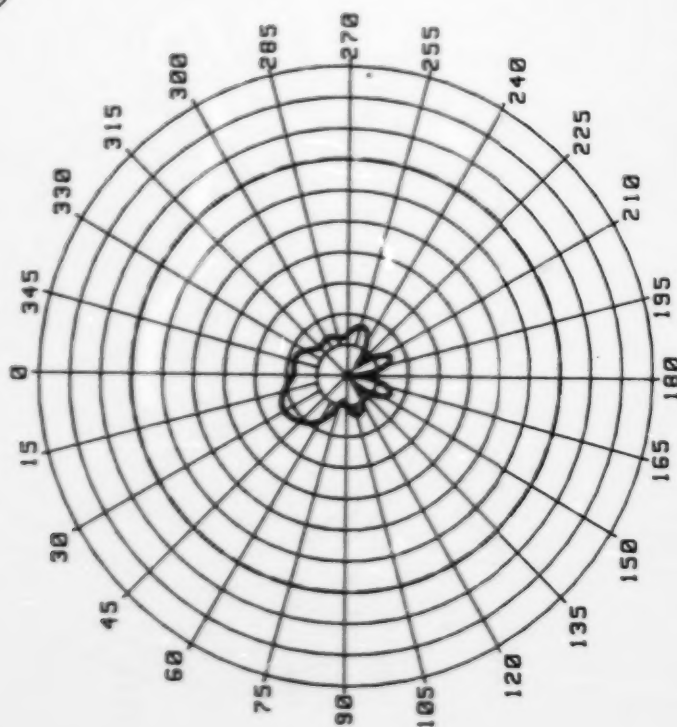
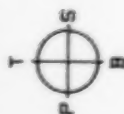
E-PHI

THE FULL-SCALE VALUE IS 1.49 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

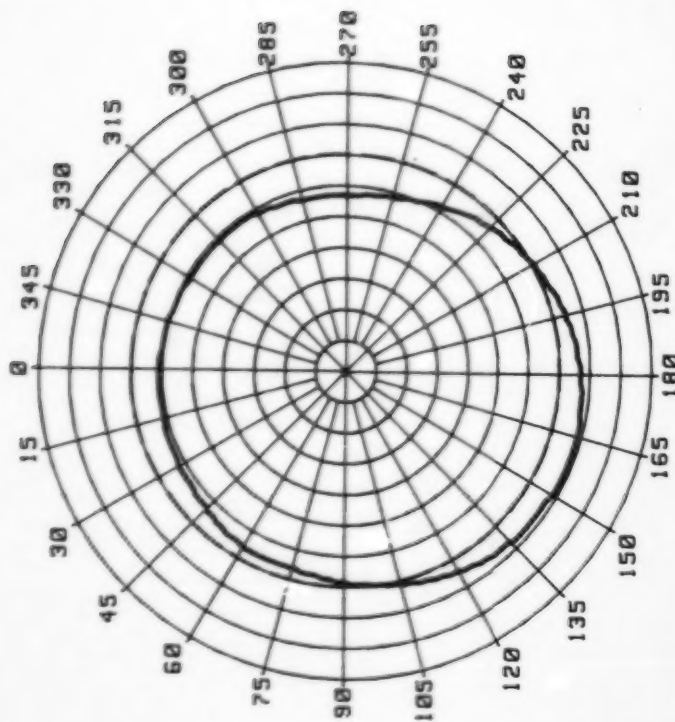
ARC ELECTROMAGNETIC ENGINEERING
8 FEB 1986 10:27:13

COMPILED FROM VOLUME ONE FILE SPECIFIER:
THE ISOTROPIC LEVEL WAS -3.48 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 600.00 MHz
CH-135 HELICOPTER 25.00 MHz
ROLL PLANE PATTERNS



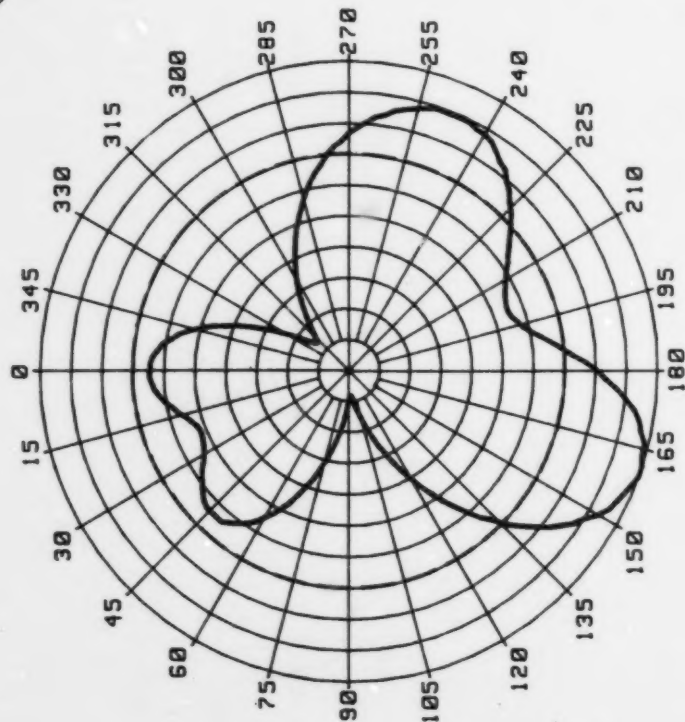
E-THETA



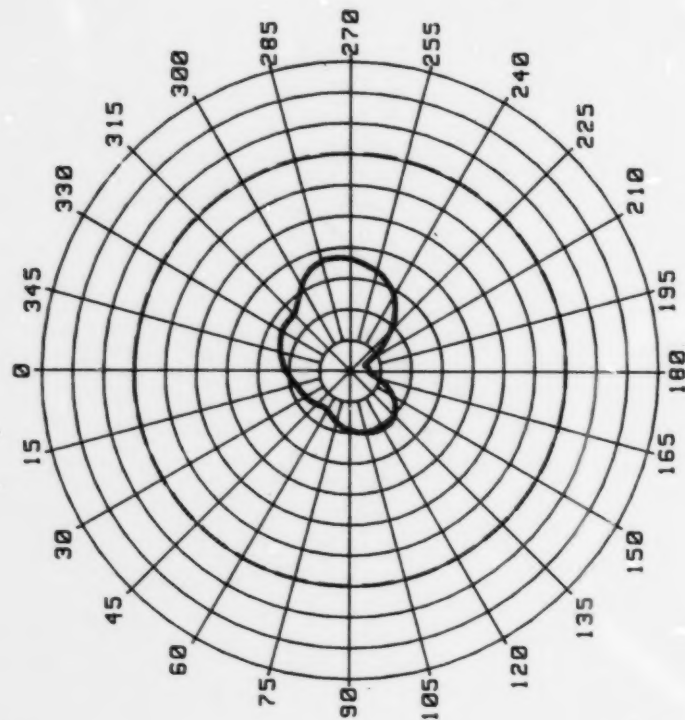
E-PHI

THE FULL-SCALE VALUE IS 1.43 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 600.00 MHz
 CH-135 HELICOPTER 25.00 MHz
 PITCH PLANE PATTERNS



E-THETA



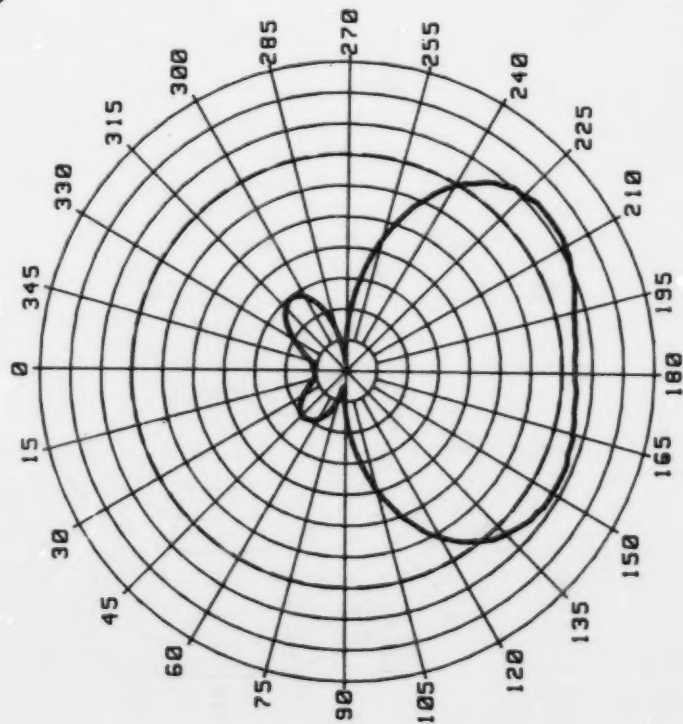
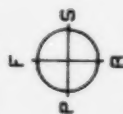
E-PHI

THE FULL-SCALE VALUE IS 1.43 [ISOTROPIC]
 --- ESTIMATED ISOTROPIC LEVEL

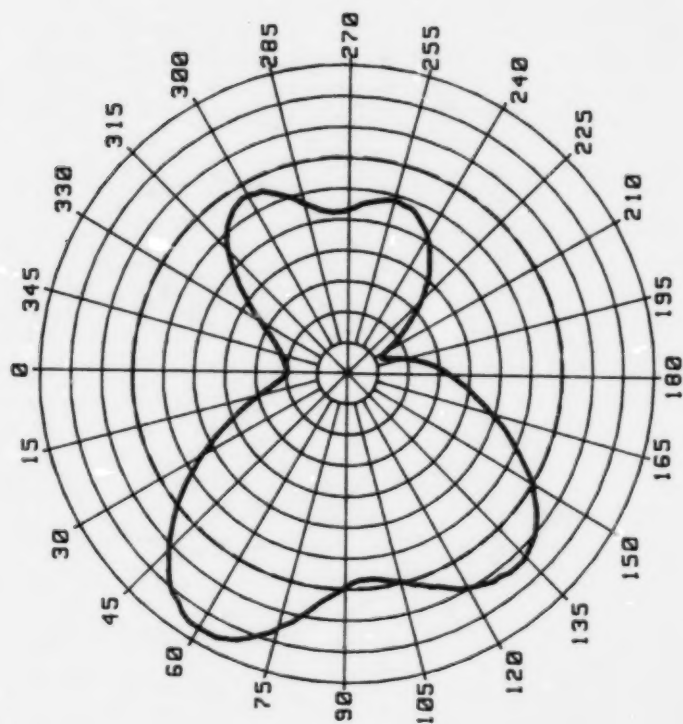
NRC ELECTROMAGNETIC ENGINEERING
6 FEB 1966 10:01:15

COMPILED FROM VOLUME ONE FILE SPECIFIC
THE ISOTROPIC LEVEL WAS -3.48 dB
MOTOR P/S

CH-135 MODEL HELICOPTER 600.00 MHz
CH-135 HELICOPTER 25.00 MHz
YAW PLANE PATTERNS



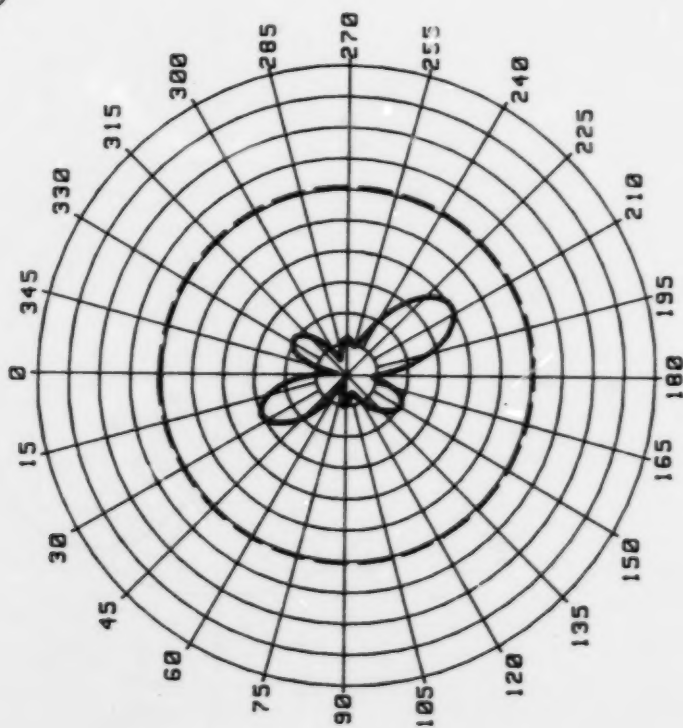
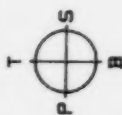
E-THETA



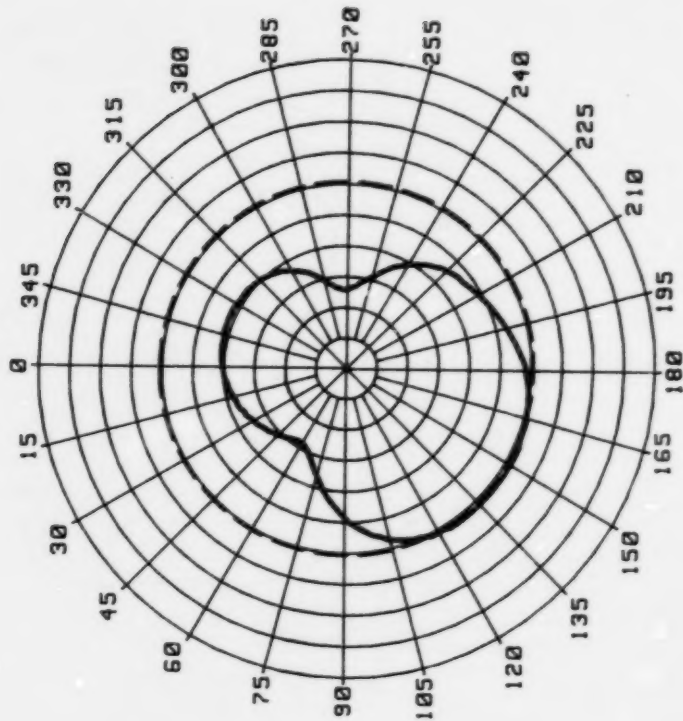
E-PHI

THE FULL-SCALE VALUE IS 1.43 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 648.00 MHz
CH-135 HELICOPTER 27.00 MHz
ROLL PLANE PATTERNS



E-THETA



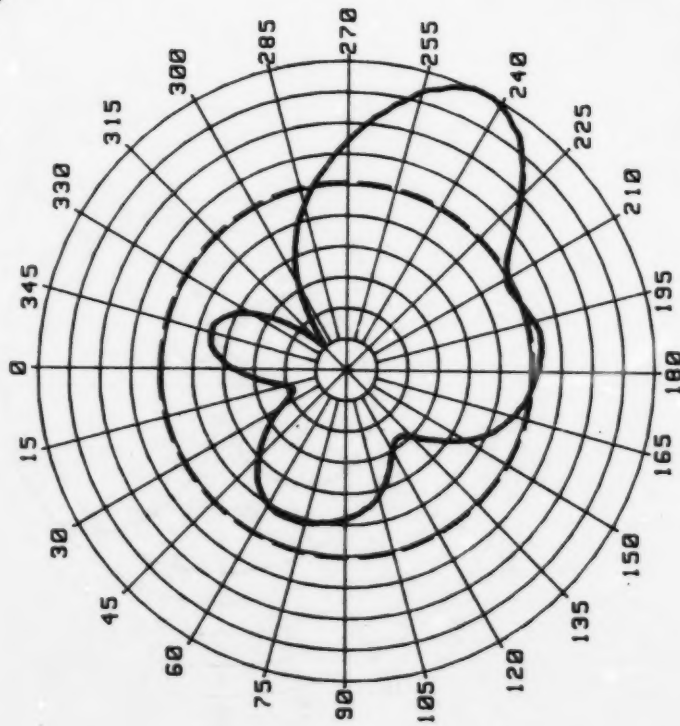
E-PHI

THE FULL-SCALE VALUE IS 1.65 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

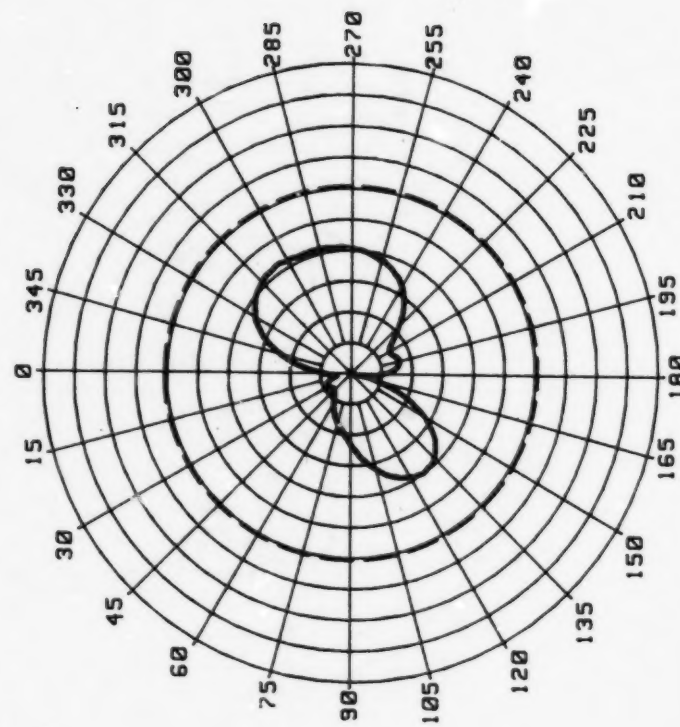
NRC ELECTROMAGNETIC ENGINEERING
6 FEB 1966 10:59:43

COMPILED FROM VOLUME CH-8 FILE SPECIFIER :
THE ISOTROPIC LEVEL WAS -5.55 dB
NOTOR P/S

CH-135 MODEL HELICOPTER 648.00 MHz
CH-135 HELICOPTER 27.00 MHz
PITCH PLANE PATTERNS



E-THETA

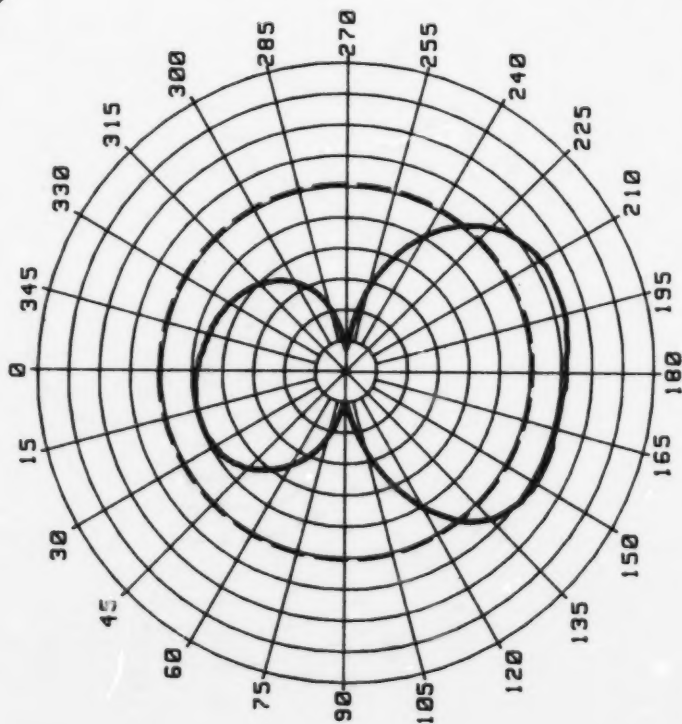
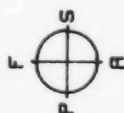


E-PHI

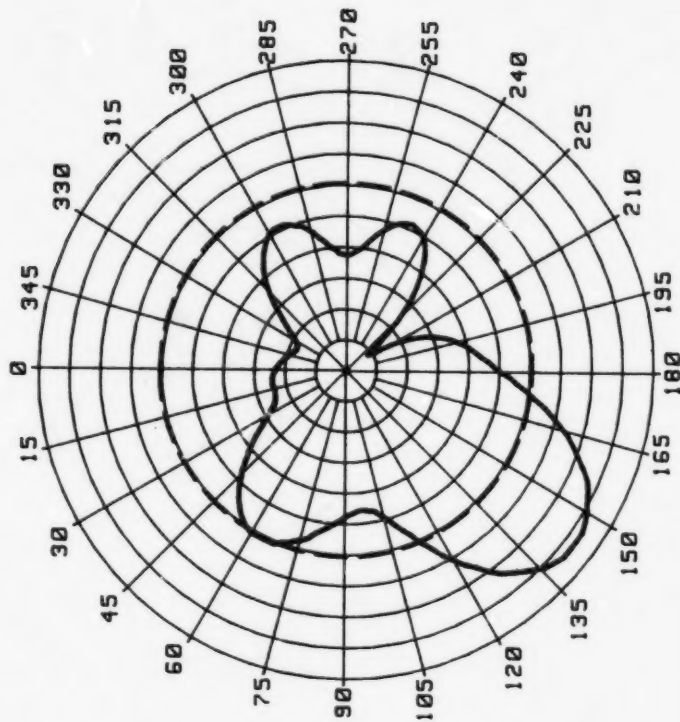
THE FULL-SCALE VALUE IS 1.65 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

COMPILED FROM VOLUME CH88 FILE SPECIFIC :
THE ISOTROPIC LEVEL WAS -3.35 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 648.00 MHZ
CH-135 HELICOPTER 27.00 MHZ
YAW PLANE PATTERNS



E-THETA



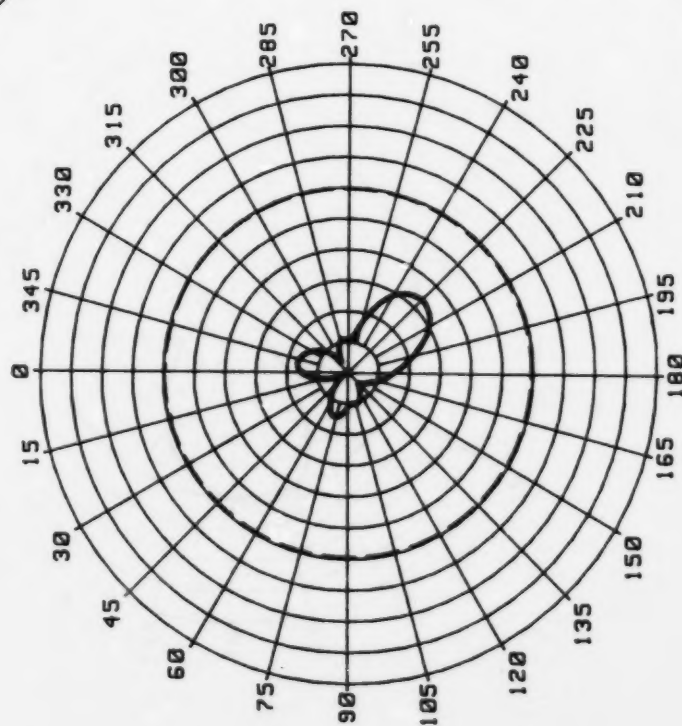
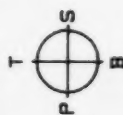
E-PHI

THE FULL-SCALE VALUE IS 1.65 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

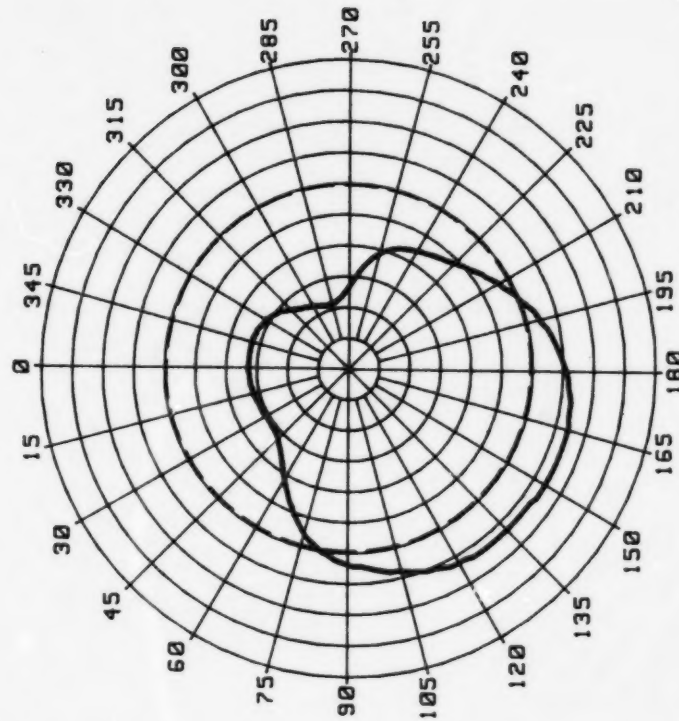
NRC ELECTROMAGNETIC ENGINEERING
6 FEB 1986 18:33:13

COMPILED FROM VOLUME CAP FILE SPECIFIER
THE ISOTROPIC LEVEL WAS -7.28 dB
ROTOR P/S

CH-135 MODEL HELICOPTER 696.00 MHZ
CH-135 HELICOPTER 29.00 MHZ
ROLL PLANE PATTERNS



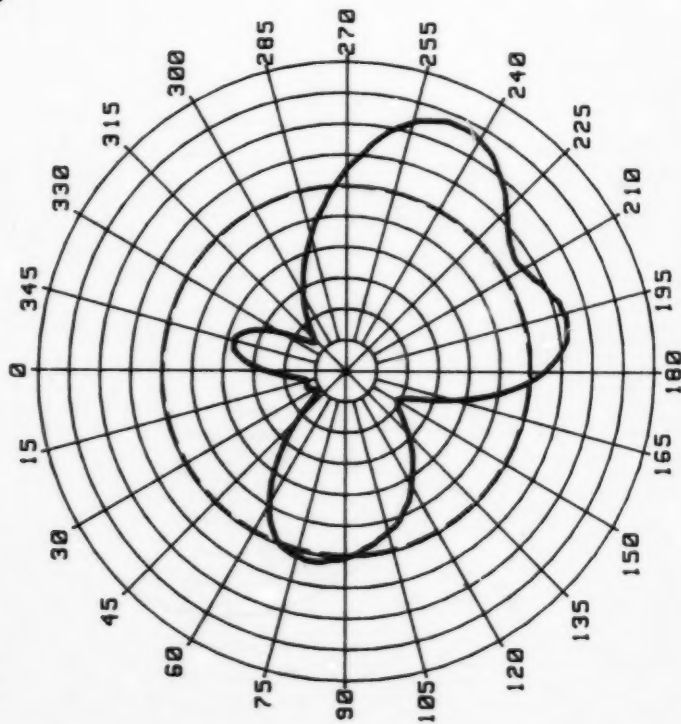
E-THETA



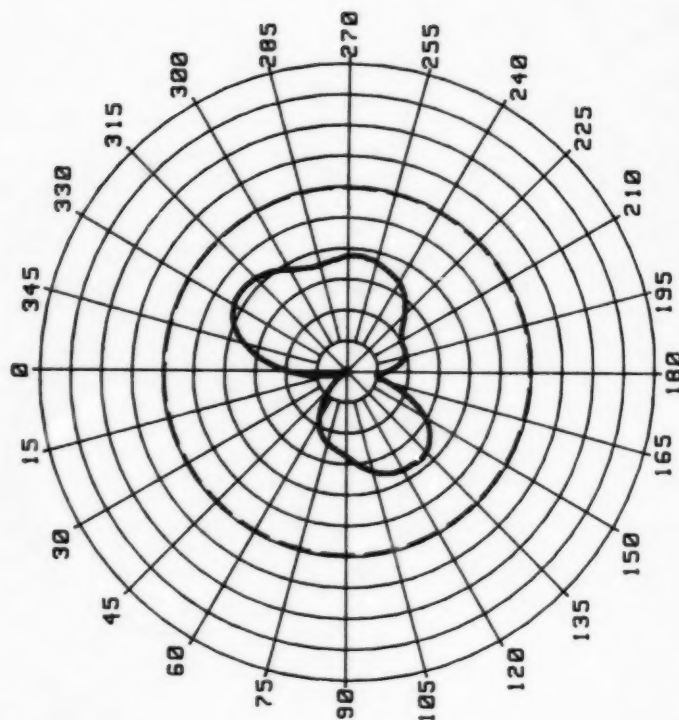
E-PHI

THE FULL-SCALE VALUE IS 1.68 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

CH-135 MODEL HELICOPTER 696.00 MHz
CH-135 HELICOPTER 29.00 MHz
PITCH PLANE PATTERNS



E-THETA



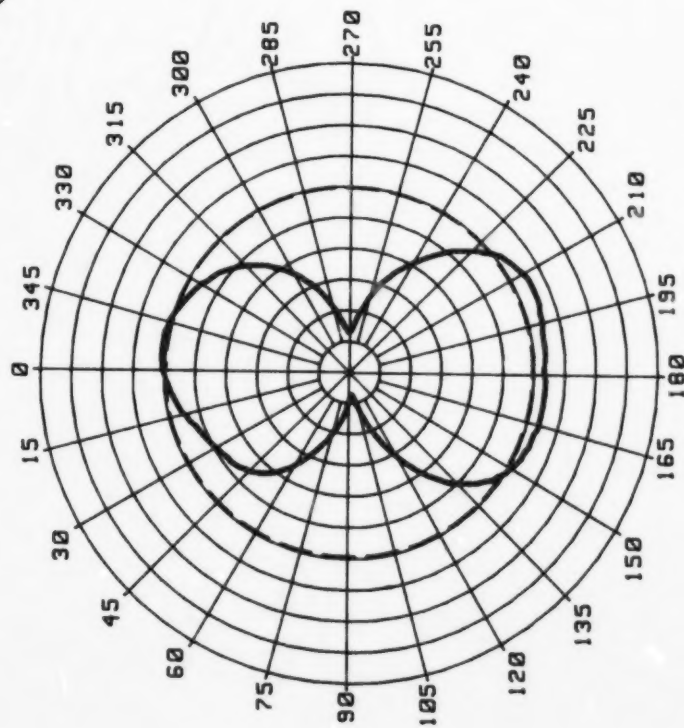
E-PHI

THE FULL-SCALE VALUE IS 1.68 [ISOTROPIC]
---- ESTIMATED ISOTROPIC LEVEL

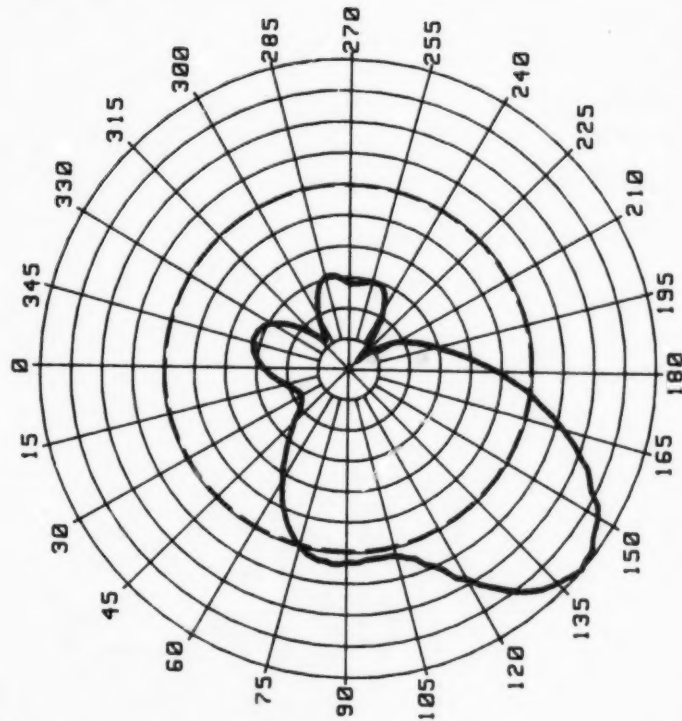
NRC ELECTROMAGNETIC ENGINEERING
8 FEB 1986 10:25:22

COMPILED FROM VOLUME CH7 FILE SPECIFIER
THE ISOTROPIC LEVEL WAS -7.28 dB
NOTOR P/S

CH-135 MODEL HELICOPTER 696.00 MHz
CH-135 HELICOPTER 29.00 MHz
YAW PLANE PATTERNS



E-THETA



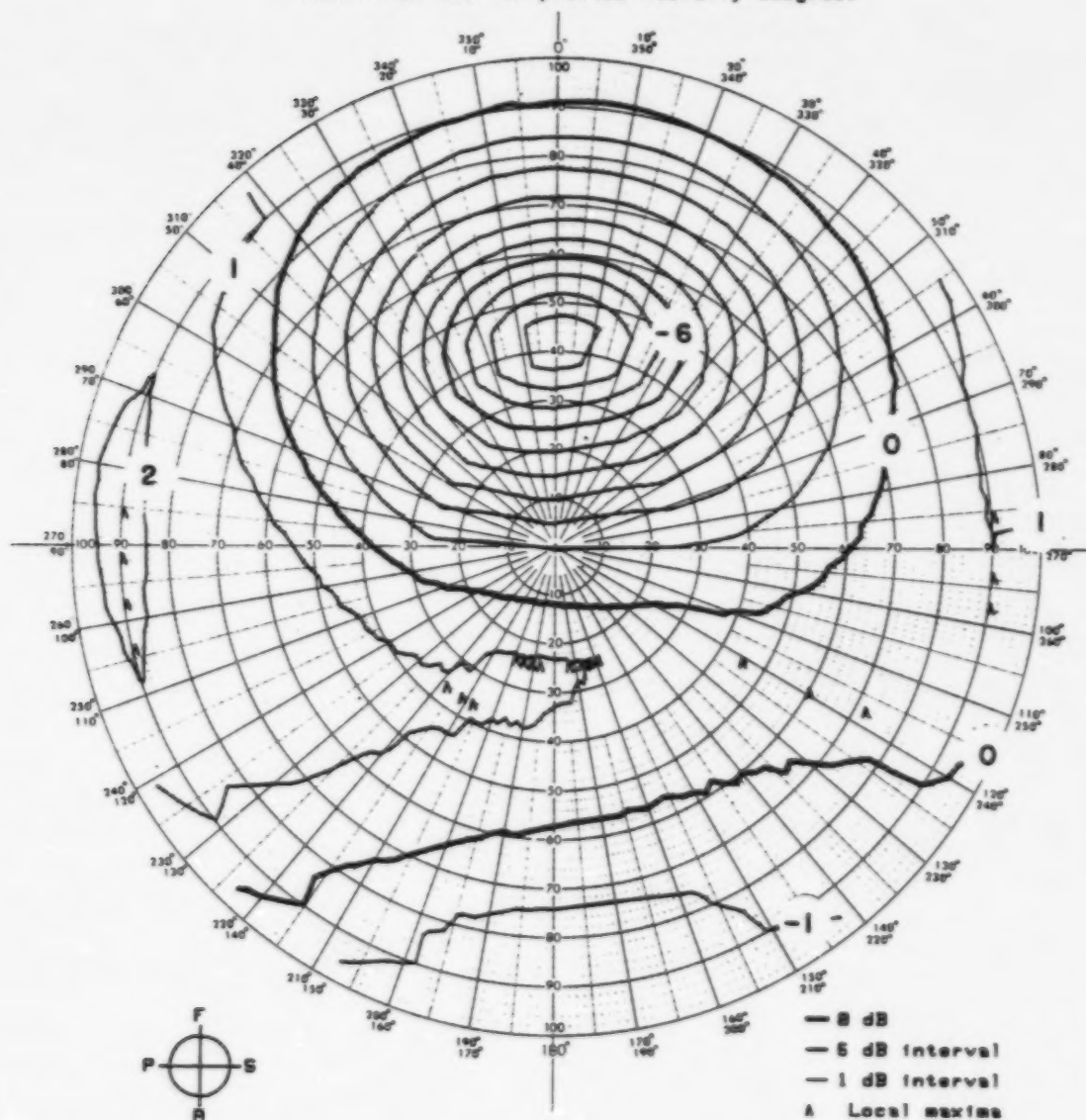
E-PHI

THE FULL-SCALE VALUE IS 1.68 [ISOTROPIC]
--- ESTIMATED ISOTROPIC LEVEL

**(c) CONTOUR PLOTS AT 8, 16, AND 24 MHz
ROTOR IN FORE-AFT POSITION**

At each frequency, contour plots of power and E_0 are presented. The sphere surrounding the helicopter has been divided into upper and lower hemispheres: one from the TOP of the helicopter to 6° below the horizon and the other from the BOTTOM to 6° above the horizon. A position diagram showing helicopter bearings appears at the lower left of each plot.

CH-135 HELICOPTER 8.88 MHz
 POWER contours
 PHI plotted angularly [degree]
 THETA from the TOP plotted radially [degree]

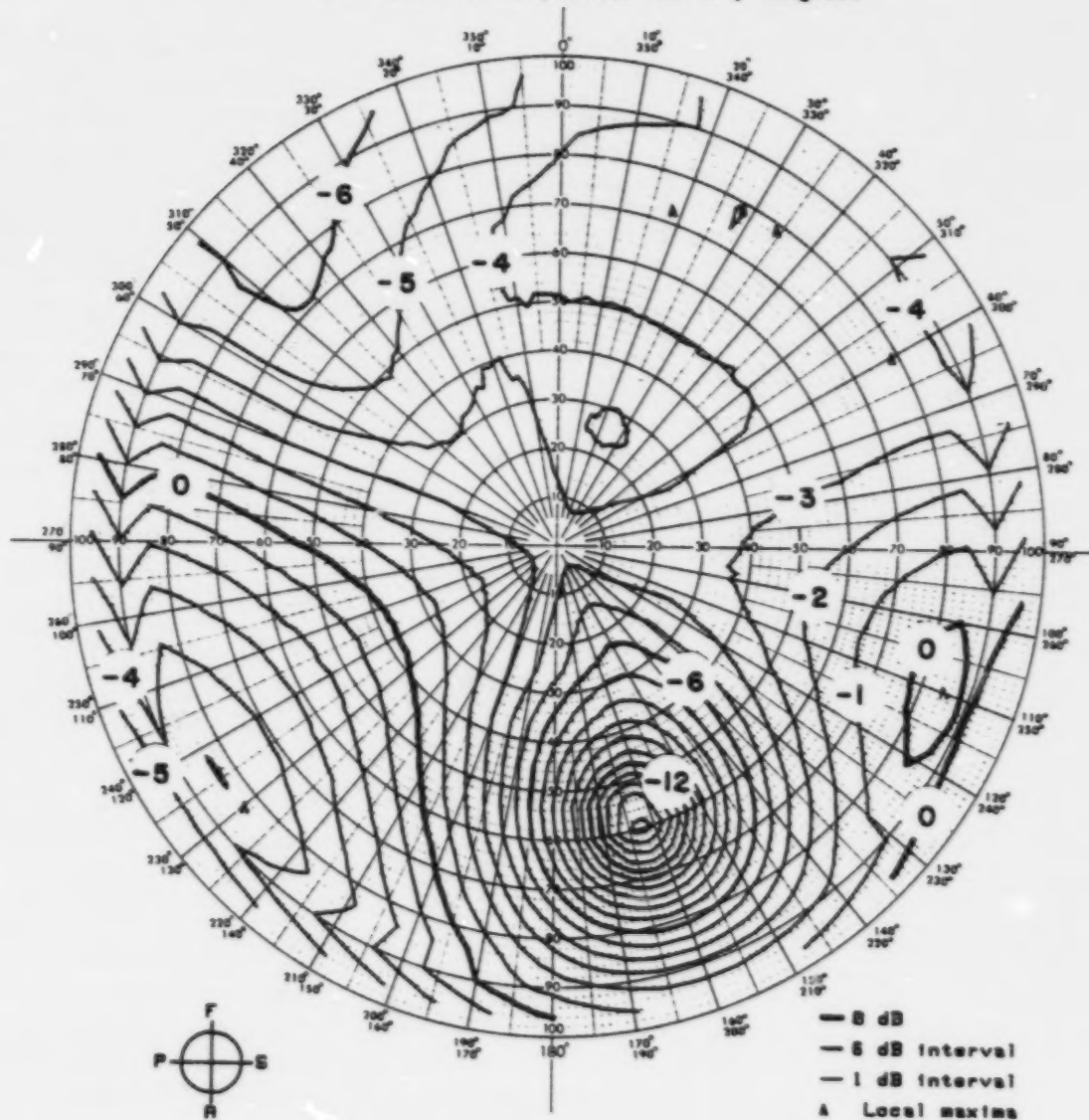


GC-127L (GC 1224-R)

(GRAPHIC) CONTROLS CANADA: COMPILED FROM VALUE ON FILE SPECIFICATION 8

Revised: 1974

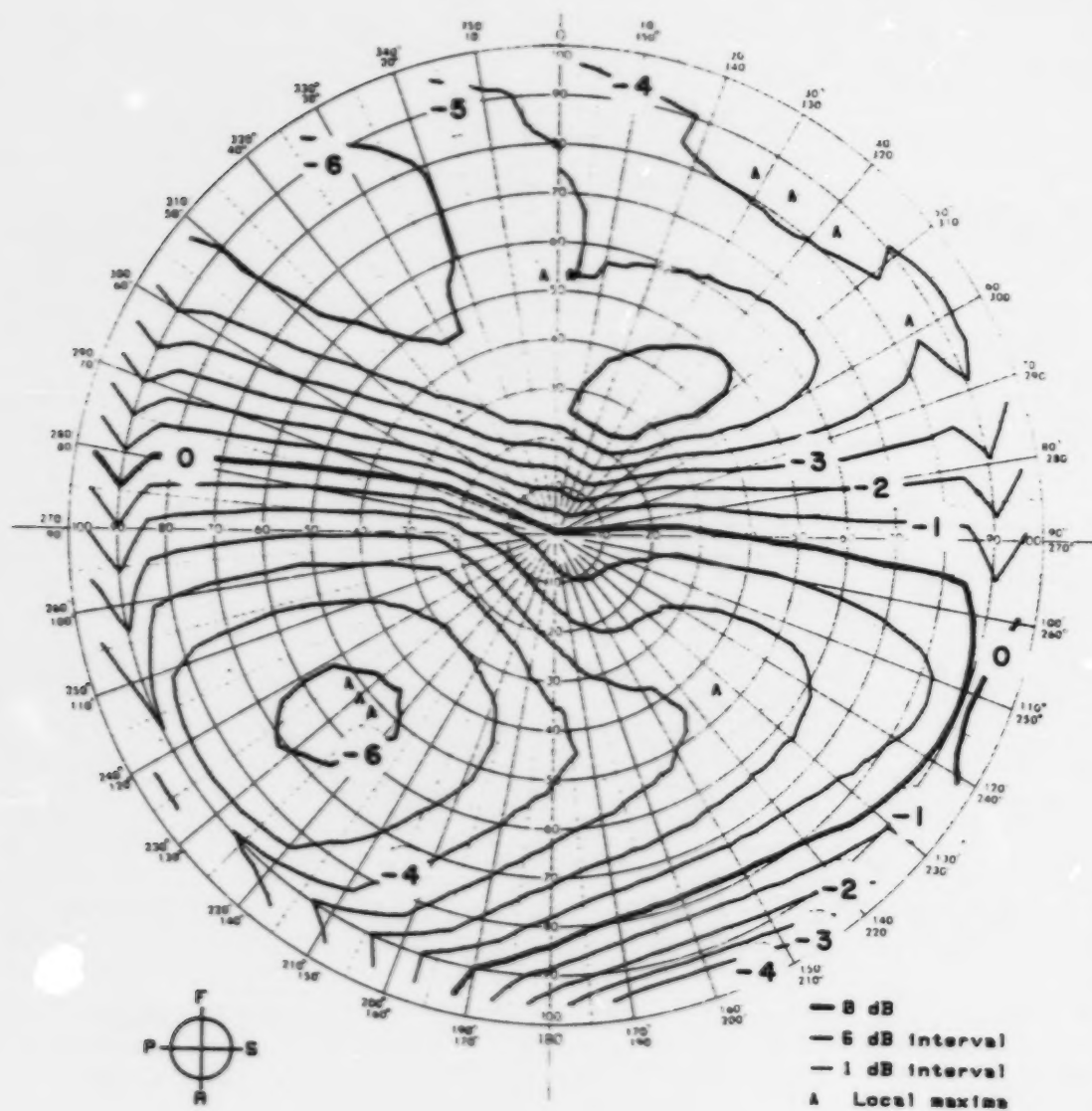
CH-135 HELICOPTER 16.88 MHz
 POWER contours
 PHI plotted angularly [degree]
 THETA from the TOP plotted radially [degree]



GC-1271 (GC 1224-R)

GRAPHED BY: CANADA LTD. EMPLOYED FROM VALUE ON FILE SPECIFIED IN
 Approved for release

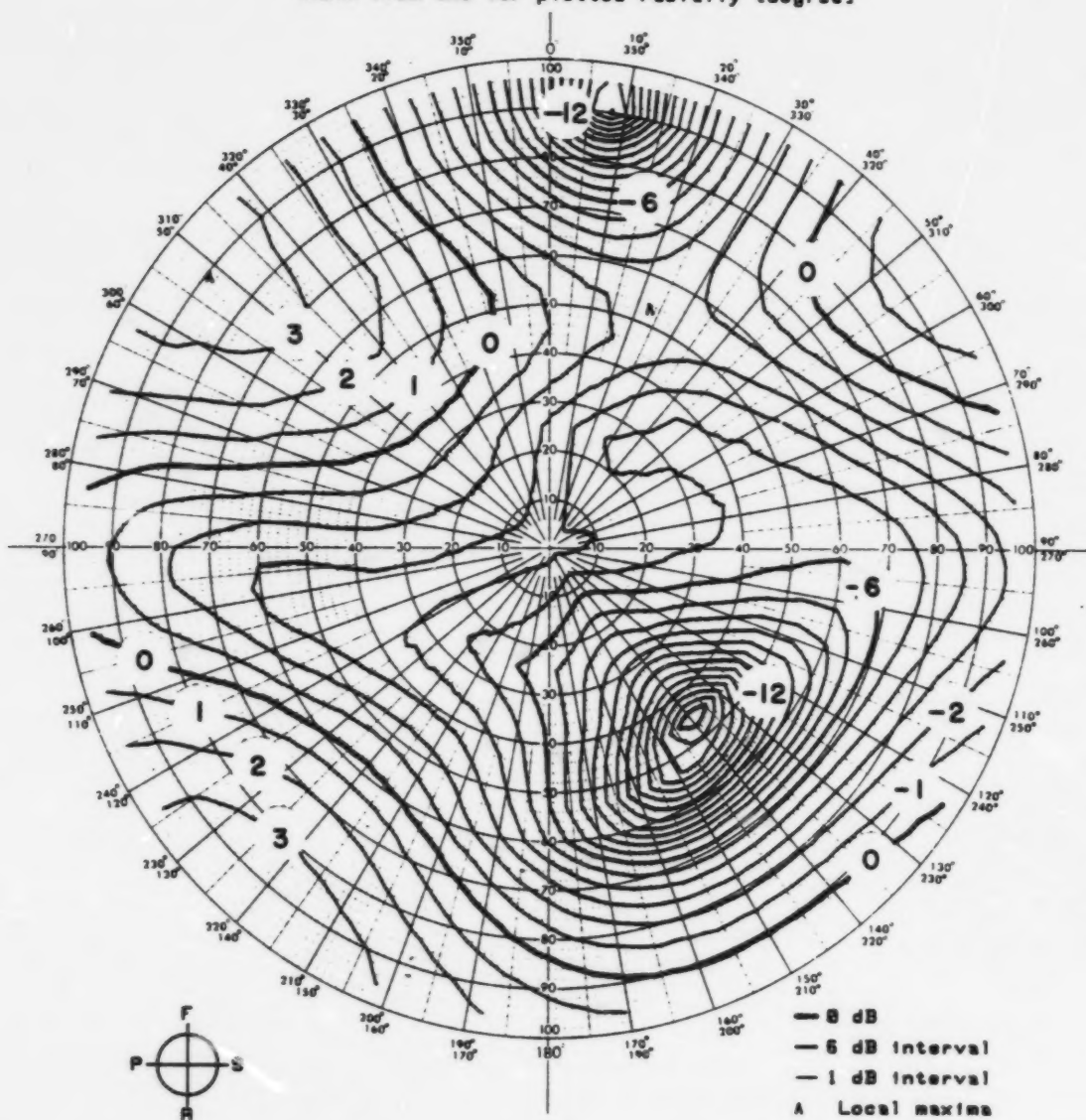
CH-135 HELICOPTER 16.88 MHz
 POWER contours
 PHI plotted angularly [degree]
 THETA from the BOTTOM plotted radially [degree]



GC-1271 (GC 1224-R)

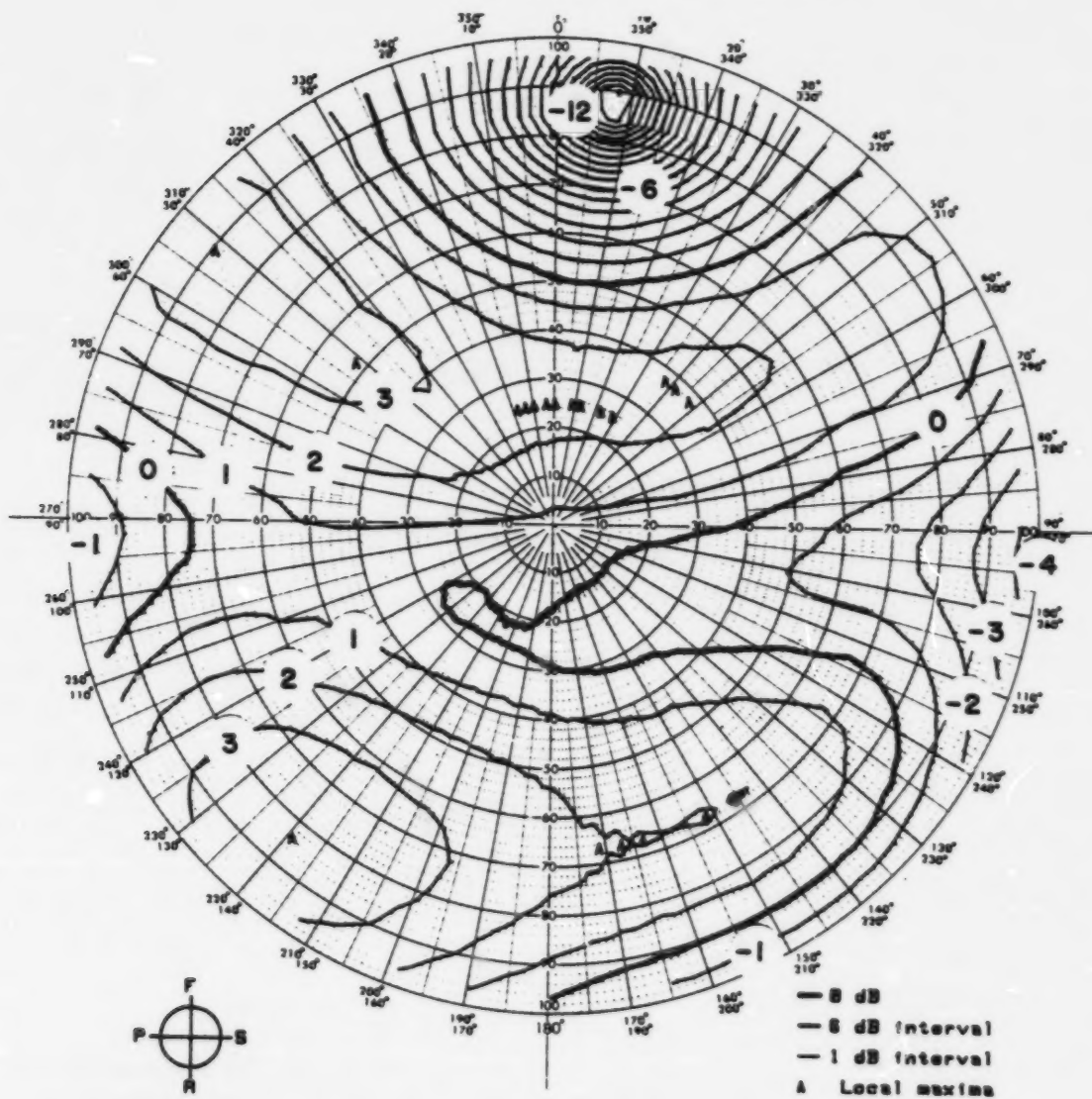
REPLACES FORM VALUE ON FILE SYSTEM 4

CH-135 HELICOPTER 24.80 MHz
POWER contours
PHI plotted angularly [degree]
THETA from the TOP plotted radially [degree]



GC-127L (GC 1224-R)
 (FRANCE) CONTROLS CANADA LTD. **COPIES FROM VALUE ON FILE SPECIFIED**
 Montreal - Canada

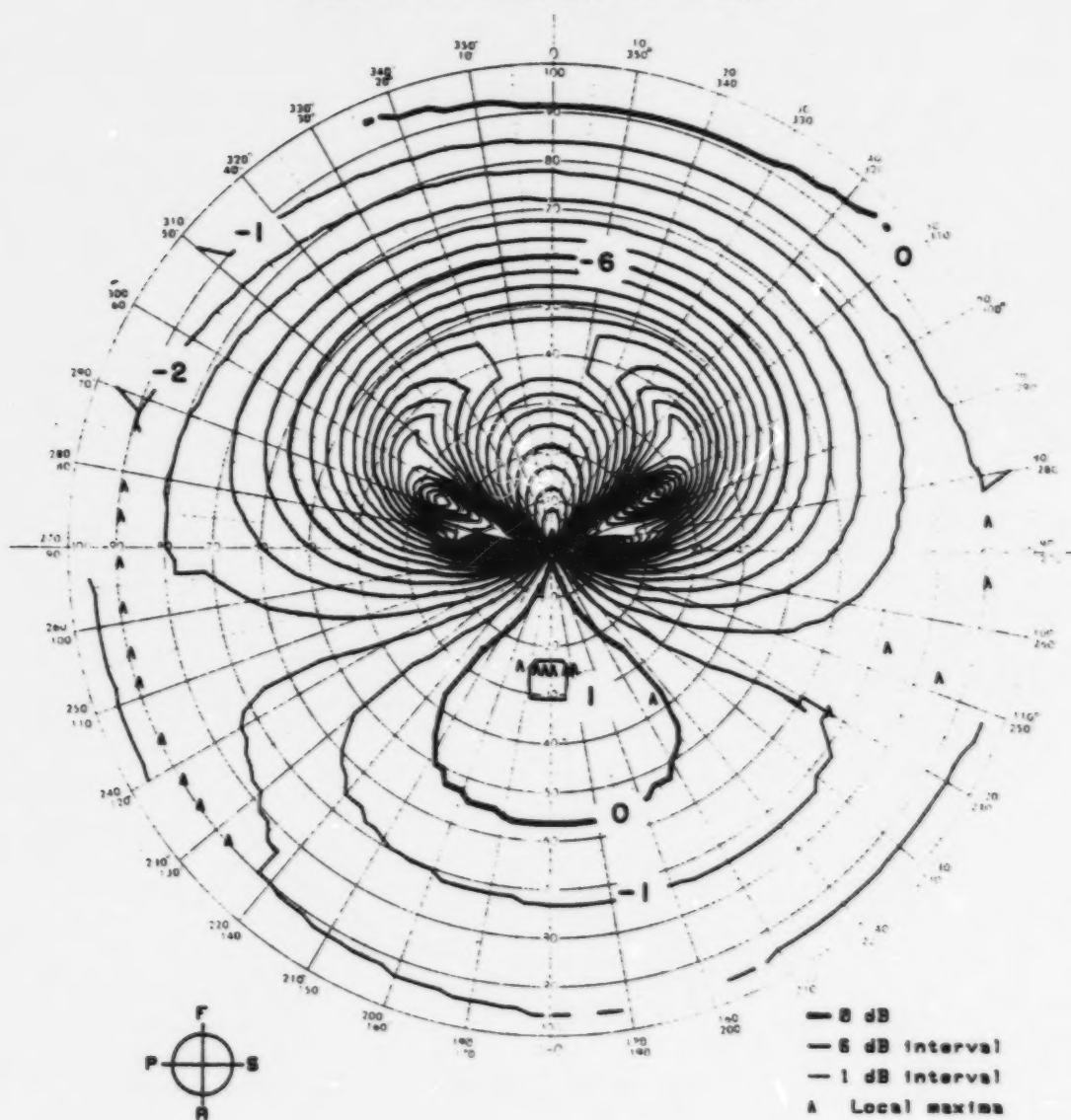
CH-135 HELICOPTER 24.88 MHz
 POWER contours
 PHI plotted angularly [degree]
 THETA from the BOTTOM plotted radially [degree]



GC-127L (GC 1224-R)

GRAPHIC CONTROLS CANADA LTD.
 Printed in Canada

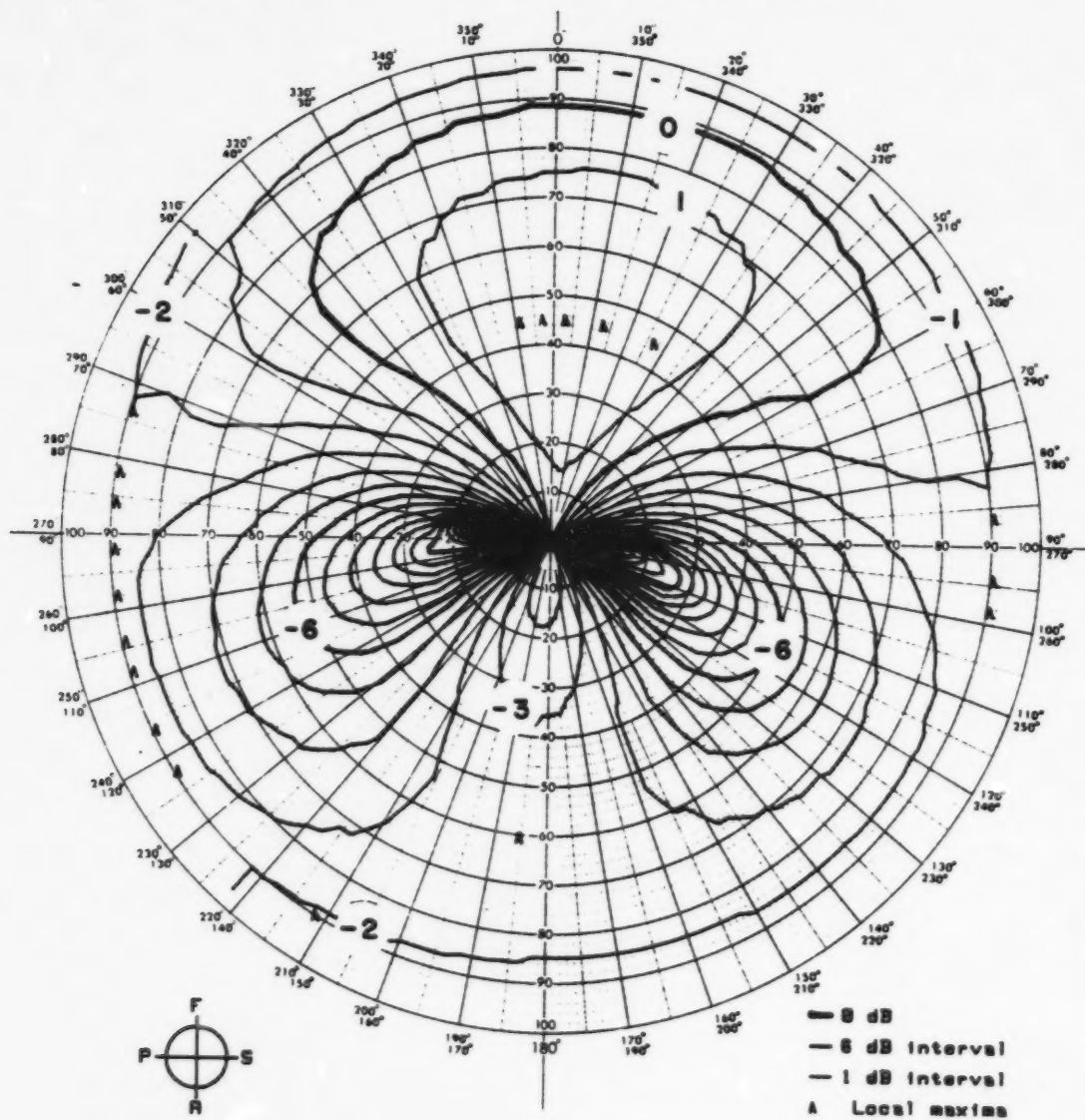
CH-135 HELICOPTER 8.88 MHz
 E-THETA contours
 PHI plotted angularly [degree]
 THETA from the TOP plotted radially [degree]



GC-127L (GC 1224-R)

REPLACES FORM VALUE AND FILE SPECIFIED 0

CH-135 HELICOPTER 8.88 MHz
 E-THETA contours
 PHI plotted angularly [degree]
 THETA from the BOTTOM plotted radially [degree]



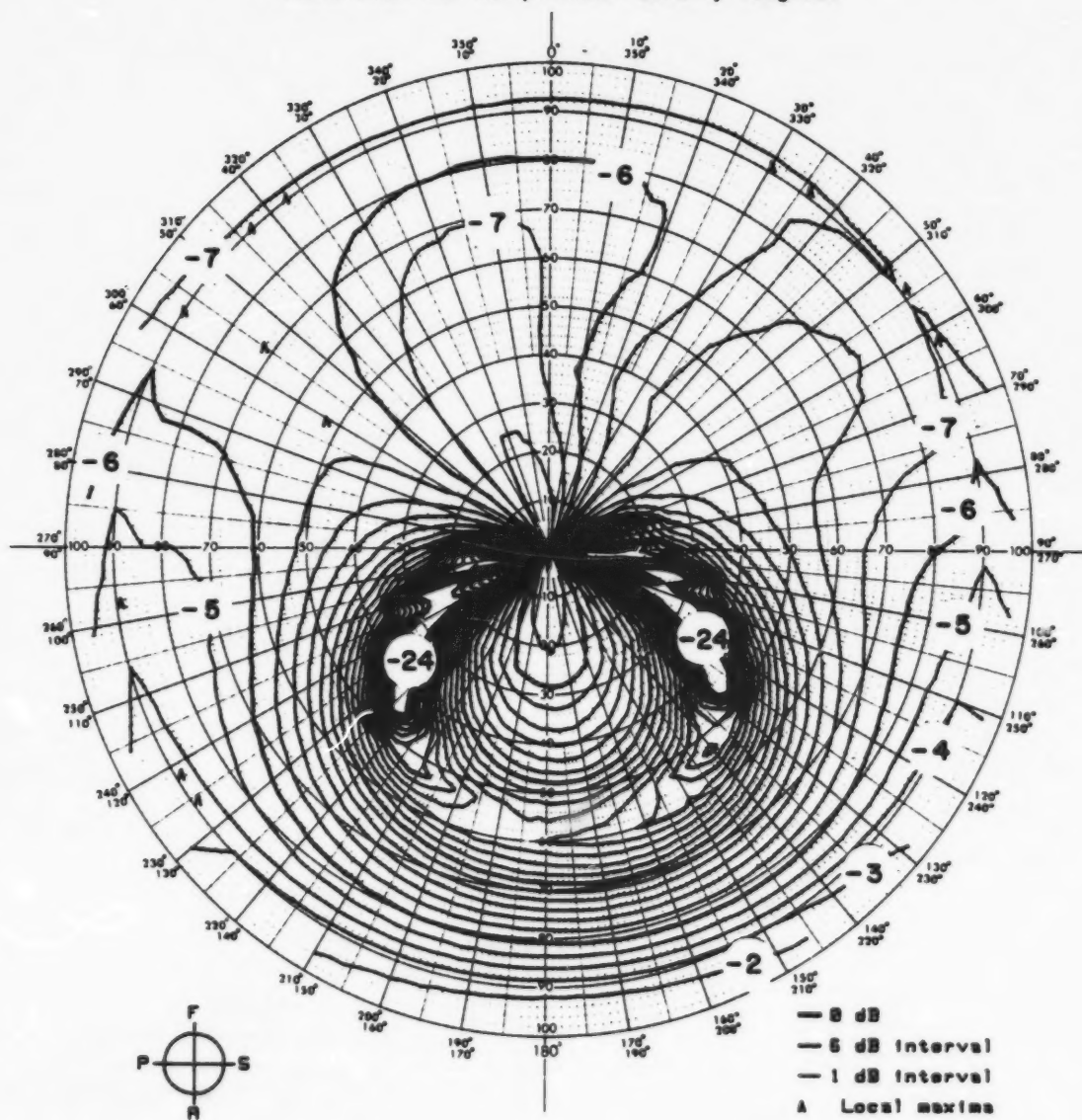
GC-127L (GC 1224-R)

GRAPHIC CONTROLS CANADA LTD.

REPLACES PREVIOUS DB FILE SPECIFICATIONS

Printed in Canada

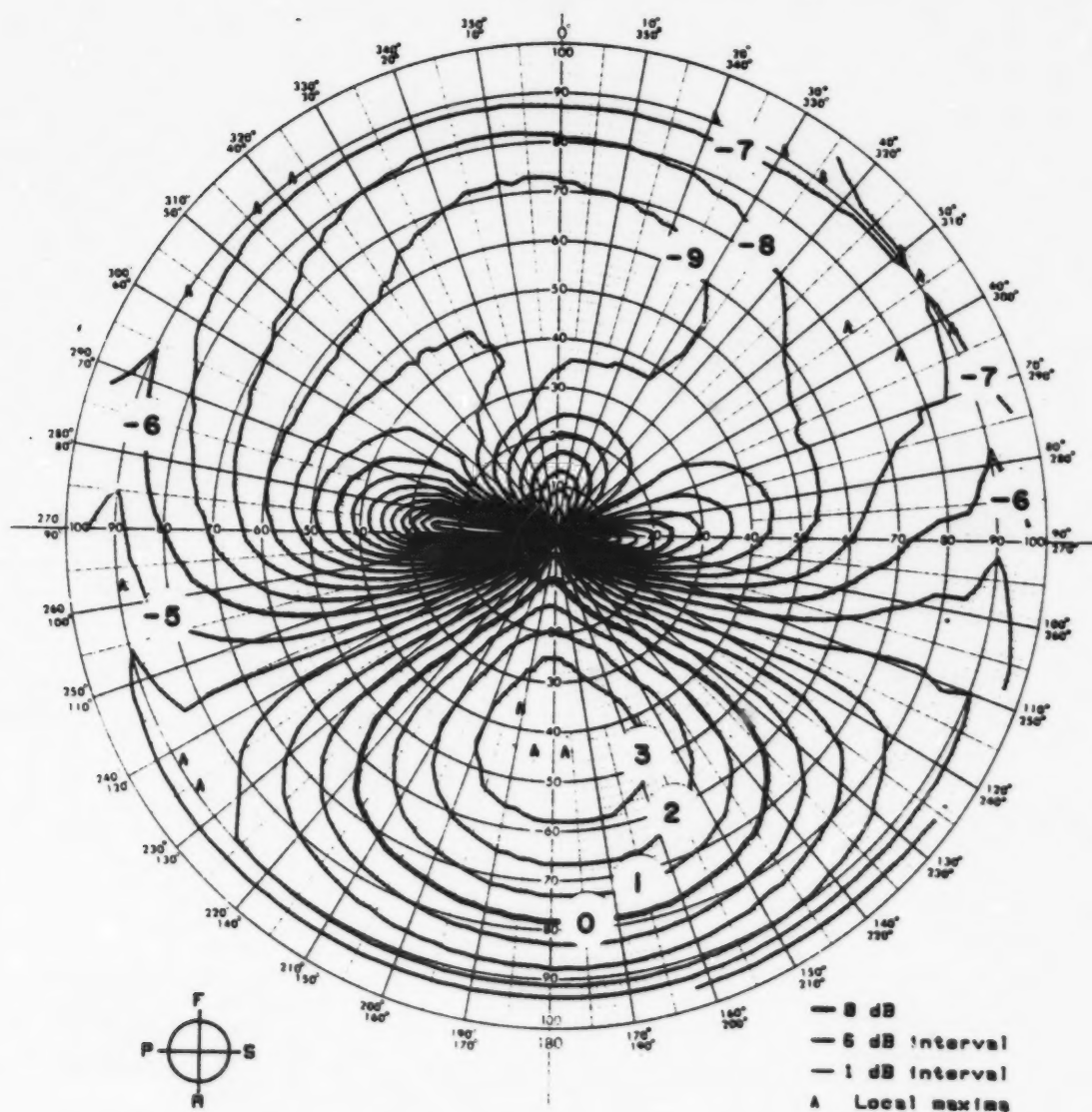
CH-135 HELICOPTER 16.88 MHz
 E-THETA contours
 PHI plotted angularly [degree]
 THETA from the TOP plotted radially [degree]



GC-127L (GC 1224-R)

GRAPHIC: E-THETA; CANADA LTD. COMPILED FROM VALUE ON FILE SPECIFIED IN
 Revised in Canada

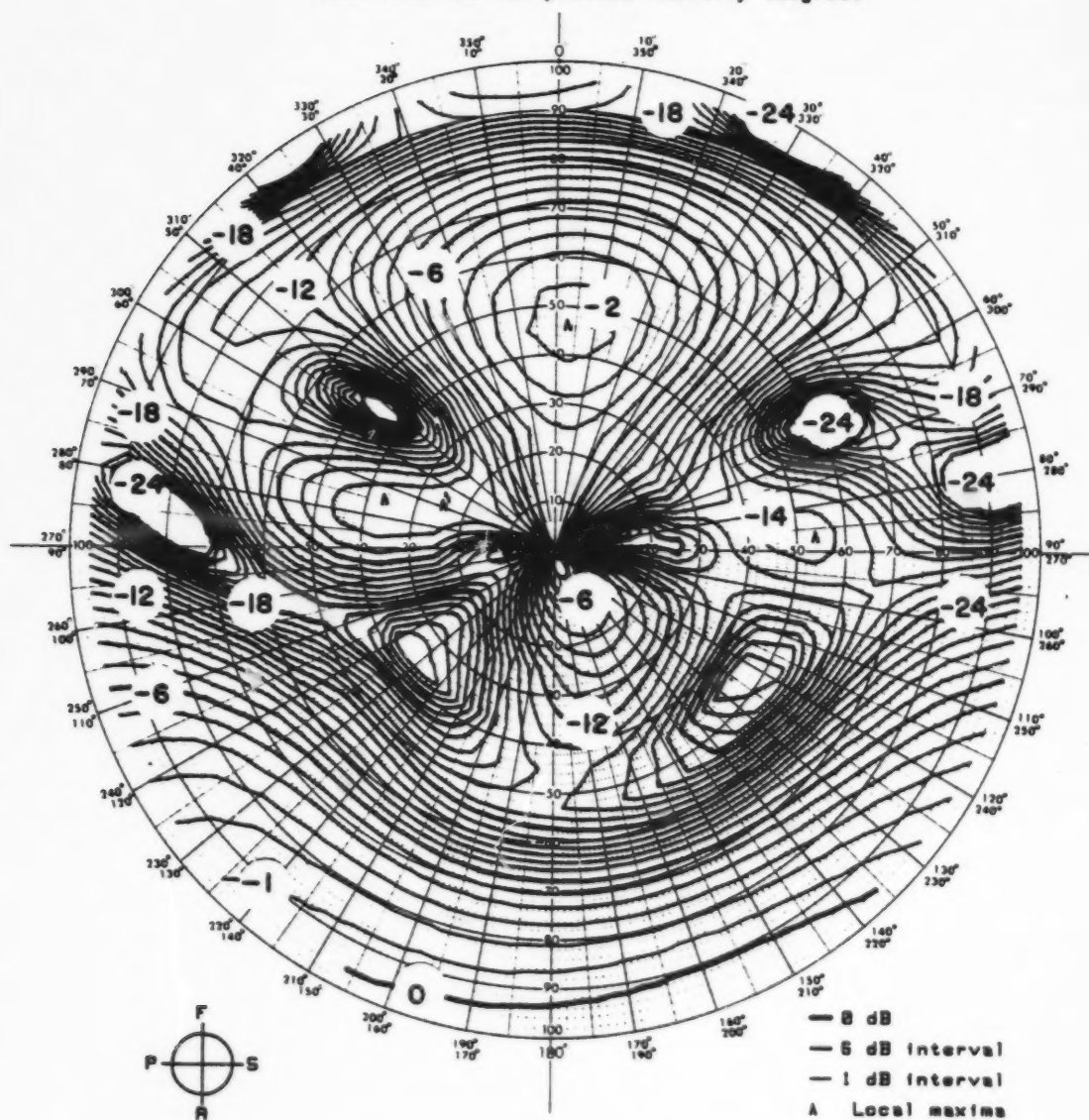
CH-135 HELICOPTER 16.88 MHz
 E-THETA contours
 PHI plotted angularly [degree]
 THETA from the BOTTOM plotted radially [degree]



GC-127L (GC 1224-R)

REPLACES PREVIOUS EDITIONS OF THIS SPECIFICATION

CH-135 HELICOPTER 24.88 MHz
 E-THETA contours
 PHI plotted angularly [degree]
 THETA from the TOP plotted radially [degree]

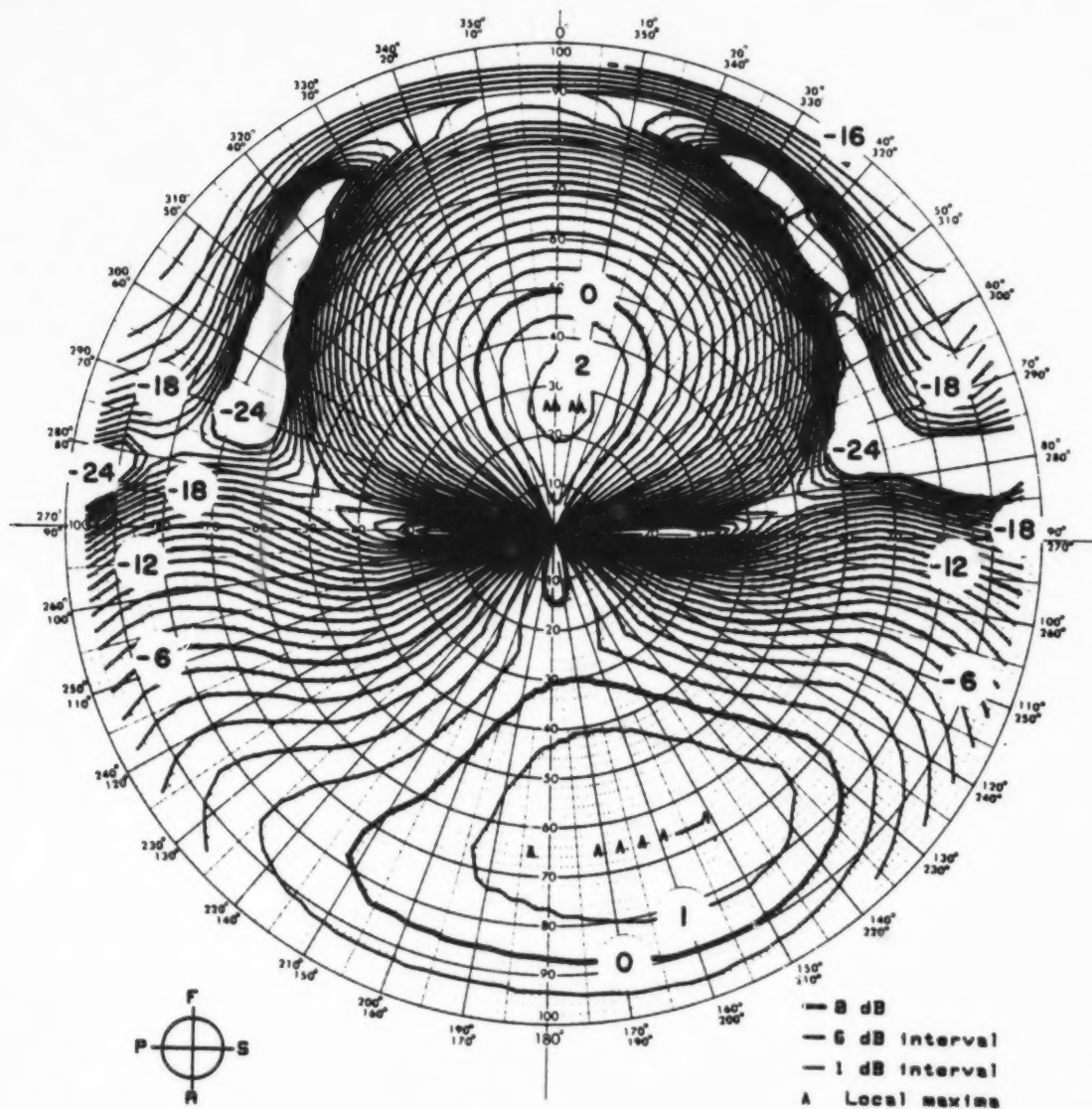


GC-1271 (GC 1224-R)

GRAPHIC L'ONTARIO S. LANAIA, TO COMPILE FROM VALUE ON FILE SPECIFIED

Revised: Canada

CH-135 HELICOPTER 24.88 MHz
 E-THETA contours
 PHI plotted angularly [degree]
 THETA from the BOTTOM plotted radially [degree]



GC-127L (GC 1224-R)

GRAPHIC: CONTROLS CANADA LTD. COMPILED FROM VALUE ON FILE SPECIFICATIONS

Printed in Canada

PART III. APPENDIX A

Nonenclature of Aircraft Pattern Measurements

Figure A1 illustrates the TOP, BOTTOM, FORE, AFT, PORT, and STARBOARD bearings of the aircraft, the coordinate system, and the two field components.

The coordinate system is a standard spherical system, and is aligned such that $\theta = 0^\circ$ is TOP, $\theta = 90^\circ$, $\phi = 0^\circ$ is FORE, and $\theta = 90^\circ$, $\phi = 90^\circ$ is PORT.

The aircraft PITCH plane ($\phi = 0^\circ$) contains measurements about the aircraft's TOP, FORE, BOTTOM, and AFT points.

The aircraft ROLL plane ($\theta = 90^\circ$) contains measurements about the aircraft's TOP, PORT, BOTTOM, and STARBOARD points.

The aircraft YAW plane ($\theta = 90^\circ$) contains measurements about the aircraft's FORE, PORT, AFT, and STARBOARD points.

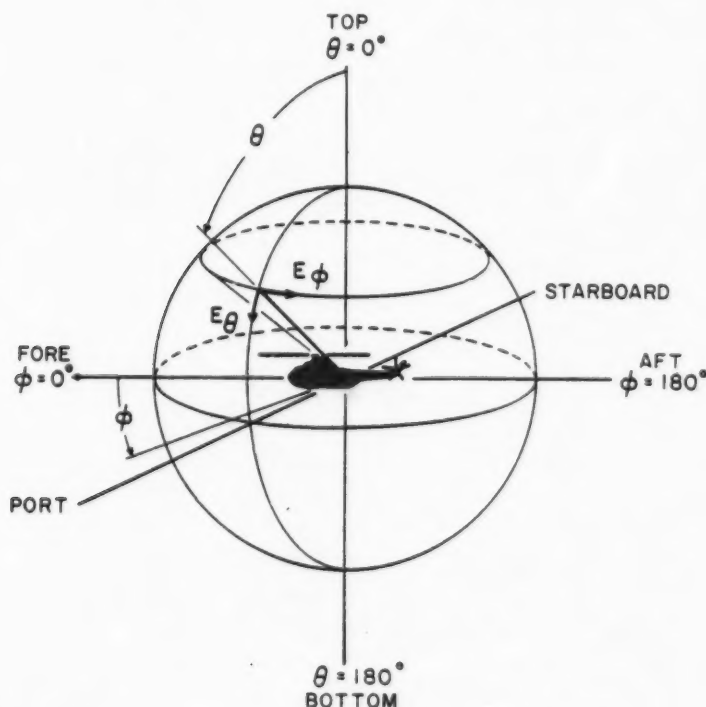


Figure A1. Aircraft, coordinate system, and field components

The PITCH, ROLL, and YAW planes are also called the principal planes and are the most frequently measured and referenced parameters in aircraft antenna pattern measurements.

There are six points where two of the principal plane patterns intersect, these are called principal plane crossover points. The location, principal planes, and field components at the crossover points are given in Table A1. There are 12 different field components to compare as each of the six crossover points has an E_θ and E_ϕ field component.

The differences between what should be equal field component amplitudes at the crossover points are called crossover errors. If the measuring and positioning systems involved are perfect, the crossover errors are due only to reflections from the surroundings because the only change is the relative direction of the surroundings to the antenna system in each case.

Table A1. Location and field components of the six crossover points

Crossover point location	Pairs of identical field components
TOP	PITCH E_θ = ROLL E_ϕ PITCH E_ϕ = ROLL E_θ
BOTTOM	PITCH E_θ = ROLL E_ϕ PITCH E_ϕ = ROLL E_θ
FORE	YAW E_θ = PITCH E_θ YAW E_ϕ = PITCH E_ϕ
AFT	YAW E_θ = PITCH E_θ YAW E_ϕ = PITCH E_ϕ
PORT	YAW E_θ = ROLL E_θ YAW E_ϕ = ROLL E_ϕ
STARBOARD	YAW E_θ = ROLL E_θ YAW E_ϕ = ROLL E_ϕ